UNIVERSITY COLLEGE LONDON
FACULTY OF THE BUILT ENVIRONMENT
BARTLETT SCHOOL OF PLANNING

# The Sustainable Last Mile: Understanding Travel Behaviours to Suburban Rail Stations

***John Surico***

*(MSc, Transport & City Planning)*

**Being a dissertation submitted to the faculty of The Built Environment as part of the requirements for the award of the MSc Transport and City Planning at University College London: I declare that this dissertation is entirely my own work and that ideas, data and images, as well as direct quotations, drawn from elsewhere are identified and referenced.**

Word count

**Main body:** 10,843

**Appendices:** 4,263

**Acknowledgments**

*Amidst uncertain and unsettling times, this dissertation would not have been possible without the solidarity of the entire TCP MSc cohort, the guidance of Prof. Robin Hickman, help from Robert Cervero and Peter Headicar, and the advice given by my partner, Angela Almeida. Credit goes as well to my friends and neighbours in Oxford, who helped give this project visibility. And to New York, where I first fell in love with transit.*

**Table of contents**

**List of figures**



**List of tables**



**List of acronyms**

BE: Built environment
CSL: Case study location
DfT: Department for Transport
OCC: Oxfordshire County Council
OP: Oxford Parkway
PT: Public transport
TOD: Transit-oriented development
TS: Travel satisfaction
UCL: University College London
UK: United Kingdom
VMT: Vehicle miles travelled

**Abstract**

The ‘last mile’ trip, from transit hub to home, is a growing phenomenon in transport research and investment. Yet it has received minimal attention in the suburbs, where most last mile trips are done by car. This dissertation explores key factors affecting travel behaviour for the last mile — the built environment; trip satisfaction; and attitudes — using UK case studies of the Oxford and Oxford Parkway railway stations. Quantitative and qualitative analyses reveal lessons for policy and governance, adding to a renewed emphasis on active travel during the Covid-19 pandemic.

# 1. Introduction

## 1.1 Research context

One of the longest ongoing debates in transport planning is a fundamental one: *what influences our travel behaviour?*

Travel, we now know, is the result of multiple variables interacting simultaneously, which can either support or contradict one another (Naess, 2012). For decades, built environment (BE) factors were considered determinative to travel. The urban form appeared to most impact mode choice, promoting public transport (PT) or 'active travel' (walking and cycling) through its density, while suburban sprawl encouraged automobile use. Recent research has complicated this picture. Planners have begun to confront travel as a public health issue: one's subjective well-being during a journey, and what said experience offers in the long-term, is of growing value. Furthermore, attitudes toward certain modes, and where users choose to live as a result, may be equally important.

Too often, researchers approach each set of factors independently, assigning significance to one over another. But inherently, these overlapping concepts must be viewed holistically (Ye and Titheridge, 2017). Now, the debate is rightly shifting to one of causality or correlation: which influences which?

Answering this question is critical. Transport is now a leading contributor to climate change, with cars comprising 60 percent of carbon emissions from road transport (Sims et al., 2018; EEA, 2019). A decades-long dominance of private cars has led to worsening air quality and congestion in towns and cities. Therefore, understanding what influences travel behaviour in order to implement changes that ultimately create more sustainable patterns has never been more consequential.

## 1.2 'Last mile' solutions

Among the fastest-growing trends in planning policy-making circles are 'last mile' solutions, or the access trips from one's doorstep to a transit stop ('first mile'), and vice versa ('last mile') (EEA, 2019).

The barriers along this journey are often cited as significant determinants of transit use (Tilahun et al., 2016). A new class of 'micro-mobility' — e.g. cycle-hire; e-bikes; e-scooters — offers viable alternatives to private

cars and has quickly become fixtures of the transport landscape in the United Kingdom (UK). Cycle-hire docks and dock-less bikes are popular in cities like London and Edinburgh; electric (e-) bike sales are skyrocketing (Ogden, 2019); and Westminster heralds e-scooters as part of a growing 'transport revolution' (Hern, 2020).

But what about the suburbs? Currently, 'last mile' innovations are largely limited to cities, although suburban settings are more in need of change. Most trips to suburban railway stations are done by private car, and hover around 4 to 5km, a distance by which tailpipe emissions disproportionately contribute to local air pollution and carbon emissions (Cervero, 1997; 2001). In effect, the car ride to the station itself offsets the 'green' benefit of using rail. Additionally, an immense amount of land is dedicated to surface parking.

The Covid-19 pandemic has renewed interest in the topic. With more people walking and cycling, the crisis is being reframed as a once-in-a-lifetime chance to reshape travel around more active uses. The Department for Transport (DfT) strategy announced in May 2020 has expedited the e-scooter approval process and dedicates £2bn for local councils to implement active travel measures (DfT, 2020). A new 'Active Travel England' office seeks to enact stricter guidelines for cycle and pedestrian infrastructure (O'Sullivan, 2020).

Rail investment has been pitched as key to the country's recovery; the UK is currently undergoing the most significant expansion of its railways since the Victorian era, after ridership doubled in the last two decades (Network Rail, 2020). But carbon savings could diminish if suburban trips are overlooked. Therefore, shifting to more sustainable modes carries significant potential in the UK and beyond, as similar conditions exist in suburban settings across Europe and North America.

In this effort, this dissertation will examine the web of factors influencing travel behaviour for last mile trips to suburban rail stations. The author will use journeys to two case study locations (CSLs): **Oxford** and **Oxford Parkway** (OP). The contrasting settings — the former, urban; the latter, suburban — offer key insights into divergent behaviours.

This dissertation will build upon research into the relationships between different phenomena influencing travel behaviours, adding new insights within a last mile context. After offering a literature review on three key themes —BE; travel satisfaction (TS); and attitudes — this paper progresses to the methodology, where quantitative and qualitative analyses provoke future policy and spatial interventions to consider. It then concludes with key findings that invoke larger issues of cognitive dissonance, push-pull factors and governance.

### 1.3 Research questions and objectives

The central research aim of this dissertation is:

> *Using the 'last mile' as a framework, how can transport planners promote sustainable travel behaviours to suburban rail stations in the UK, and beyond?*

This aim will be examined through five queries:

1. **How statistically significant are household characteristics, attitudes and travel satisfaction on mode choice?** This question accounts for individual and categorical data.

2. **Which BE factors are statistically significant on last mile decisions?** This question confronts the '5D' model.

3. **How do perceptions of walkability and cyclability affect travel?** This question considers themes of subjective well-being.

4. **To what extent does cognitive dissonance exist between attitudes and behaviours?** This question examines the effect of user attitudes and preferences on decisions.

5. **What are potential interventions for promoting a sustainable last mile?** This final question will pair findings with expert-led solutions.

The objectives of the dissertation include:

- Analysis of key themes affecting travel behaviours in the last mile context;
- A better understanding of the relationships between said themes;
- A cohesive look at potential interventions at local and national scales.

## 2. Literature Review

### 2.1 Built environment

The effect of BE on travel behaviour became a focal point with the seminal work of Newman and Kenworthy (1978), whose research posited that dense city dwellers travel less per capita than suburbanites. The authors' continued studies (1989, 1999) inspired movements like New Urbanism, which promotes transit-oriented development (TOD) around stations to reduce car dependency.

BE factors were codified through the work of Cervero and Kockelman (1997), whose '3D' model — *density* of a local area; *diversity* of land use; and *design* of said area — became a baseline for travel behaviour research. In order to encourage 'walk-and-ride' instead of 'park-and-ride' at suburban rail stations, Cervero (2001) argued that planners should densify available parking space, as mixed-use development (residential and retail) would create an inviting environment. Updated with contemporary research, Ewing and Cervero (2001) added two more 'D's: *distance* to a downtown centre; and *destination accessibility*.

Independent BE factors are demonstrably inelastic with trip time and frequency (Ewing and Cervero, 2010), but paired or aggregated, the elasticity proliferates. Destination accessibility — or the ease of access to places of interest, both locally and regionally (Handy, 1993) — has proved to be the most strongly correlated with vehicle miles travelled (VMT). This has inspired talk of the "15-" or "30-minute" city (Levinson, 2019), where residents can access everything they need — i.e., food, leisure, work — within a short walk or cycle ride.

A growing body of research speaks to last mile conditions encouraging or discouraging transit use (Tilahun et al., 2016). In this context, BE factors are granular; instead of city-level metrics, ground-scale journey features come into focus, questioning the real-time applicability of the 5D model. Walking may be less constrained by density, and more by diversity or design. Cycling could be a matter of destination accessibility, rather than diversity. And driving could result from distance above all. At this level, Krizek (2003) found that neighbourhood accessibility, like destination accessibility, is explicitly linked to VMT.

Over the years, Newman and Kenworthy's work has attracted criticism (Handy et al., 2005). Ewing and Cervero (2001) found BE factors more prevalent in affecting trip lengths than frequency, and that socioeconomic characteristics were just as statistically significant. Factors influencing one's willingness to walk have been found to be much more complex than neighbourhood design (Weinstein Agarwal et al.,

2008); other non-built factors, like perceived levels of safety, are equally as important (Tilahun et al., 2016). The significance of BE factors also dissipates when including attitudes, which will be explored shortly.

Another increasingly recognised element is parking; namely, whether users have safe, affordable and accessible car or cycle parking — both at home and the station — has been significantly linked to ownership and use, after controlling for socioeconomic characteristics (Yin, Shao and Wang, 2018; Aditjandra, 2013). The availability of free parking has been dissected by Shoup (2001) as a primary motivation behind car use in cities.

### 2.2 Subjective well-being and travel satisfaction

Researchers are paying greater attention to TS, which is classified here as the satisfaction with a trip, and general travel (De Vos and Witlox, 2017). TS can be perceived through the 'subjective well-being' paradigm (Ettema et al., 2010), which questions short-term well-being (immediate emotions), and medium- and long-term (or eudaimonic) well-being. Individual TS can yield positive or negative emotions, which then impacts satisfaction with daily travel, affecting 'domain satisfaction,' or satisfaction felt towards one's environment, and, ultimately, life satisfaction. Subsequently, those attitudes can influence aspects of an individual trip, thus returning to square one (De Vos and Witlox, 2017).

Studies show that TS is influenced by multiple elements, including mode choice and trip distance, which have bidirectional relationships (Ibid, 365; Ettema et al., 2010; Stutzer and Frey, 2004). In terms of travel behaviours, TS implies that humans typically seek to improve their well-being; however, how that plays out is less clear. TS is not formulaic: short journey time matters little if beside a busy roadway — a common contradiction in suburban contexts (Ye and Titheridge, 2017). Active travel often scores the highest for individual TS, as well as domain and life satisfaction (De Vos and Witlox, 2017), but driving a car through minimal traffic can exhibit similar feelings (Ettema et al., 2010). Self-perception, or how one believes they are viewed in said mode, also contributes to overall travel experience (Steg, 2005).

With shorter trips in mind, TS research enters the last mile conversation through walkability and cyclability, or lack thereof. How a journey is *experienced* — and henceforth *perceived* — by users could unearth links into current, or potential, behaviours. If a user does not see their domain, journey or destination as walk- or cycle-friendly, they may choose modes with more negative TS, which could ripple across livelihoods.

First, consider walkability. On-street characteristics of a 'place' — i.e. number of people around; sitting areas; green space; traffic presence — influence our choices to walk through said place (Carmona et al., 2018). Walkability can also be affected by pedestrian design, or BE factors that encourage walking, like safe crossings, shorter blocks and other 'traffic calming' measures (Tilahun and Li, 2015).

Cyclability has similar enablers and deterrents as walkability (Handy et al., 2014). Cycling infrastructure is often studied by the kilometres of lanes, and their quality (shared vs. segregated; network connectivity; etc.), although this formula prioritises existing cyclists over newcomers (Ibid, 8). However, TS along said routes is crucial to understanding cyclability: in a study of various UK cities (Oxford included), Cervero et al. (2019) found that perceived stress, particularly as it relates to on-road traffic, was the most determinative factor of a city's cycling rate, beyond even distance and socioeconomic characteristics.

Given the CSLs, it is worth confronting two relevant design models: roundabouts, and 'Park & Rides.' Roundabout junctions may deter walking and cycling, as crossing can take several minutes, and users have trouble distinguishing traffic flow, given the lack of stoplights (Stone et. al, 2002). In this way, unpredictability fosters inaccessibility. Recognising that traffic — namely speed, volume, and noise — can impact walkability and cyclability, the Park & Ride, where drivers park on the periphery and take public transit into a city centre, is relevant (Meek et al., 2010; 2011). Challenging claims of congestion mitigation, research has shown that Park & Rides can effectively increase VMT, as users consider trips they otherwise would not have taken (Parkhurst, 1995, 1996; Hamin Abdul et al., 2008). As a result, Park & Rides may heighten traffic levels locally, where last mile trips are made. Strikingly, the model was first introduced in Oxford in the 1970s before gaining popularity nationwide.

Short-term trip emotions are where TS confronts BE. For example, diverse land use (BE) attracts people, thus spawning a more walkable or cyclable environment (TS) (Mo et al., 2018; Shriver, n.d.). And as indicated, TS is inexplicably linked to our perceptions and attitudes.

### 2.3 Attitudes and residential self-selection

Each person holds a series of perceptions, attitudes, and preferences (Aditjandra, 2013). Perceptions are fuelled by beliefs towards one thing, and valuations of alternatives; attitudes reflect worldviews derived from said perceptions; and preferences are behavioural changes made as a result. Over time, preferences solidify habits, or routine, automatic decisions which are hard to unravel (Schwanen et al., 2012). Habits underlie decision-making processes, rendering them crucial in understanding travel behaviours (Ibid, 523).

Attitudes towards travel modes can be formed at a young age; take, for example, Dutch children and early cycling (Ibid, 538). Significant life events — an unsafe bike ride as a child; a teenager's first car; a crash while walking — can send tremors up this psychological ladder, helping to instil deeply-held predispositions.

In addition to individual, collective perceptions also matter. Frequently cited is the 'theory of planned behaviour,' where societal and cultural norms influence what users perceive as acceptable (Anable, 2005). If walking is uncommon in one's neighbourhood, or perceived as inferior amongst acquaintances, that reinforces an anti-walking attitude. The phenomenon of 'car fixation,' where users attribute personality and lifestyle characteristics to their car, is a living embodiment of this theory (Matthies and Klöckner, 2015).

Attitudes have been linked to residential self-selection, where users seek neighbourhoods reflecting their predispositions (Bohte et al., 2009; Chen et al., 2017). Pro-car users are more likely to favour suburban, auto-centric design, while pro-PT users gravitate towards an urban area with those options. Proximity to a transportation hub may matter less to the former, and more to the latter. And once relocated, a change in neighbourhood accessibility can impact users' travel behaviours (Krizek, 2003).

Conversely, this research, if ignored, could place too much relevance in BE, which shapes — and is shaped by — where one chooses to live (Kitamura et al., 1997; Bohte et al., 2009). Between TS and attitudes, the relationship is bidirectional: if a user is pro-cycling, then they're more likely to retain TS from cycling, reinforcing the original inclination (Ye and Titheridge, 2017; Naess, 2012). And if TS influences perceptions, thereby creating attitudes and preferences towards certain modes, then last mile conditions are unquestionably important to study (Hickman and Vecia, 2016).

### 2.4 Research gaps

This dissertation aims to deepen travel behaviour research within the last mile context. It will do so by analysing crosstabs between the key themes mentioned (BE, TS, and attitudes), and how they specifically relate to travel to a destination; in this case, the first and last mile between home and a railway station. Critiquing attitudinal research, this dissertation will also explore the role of cognitive dissonance, or whether users travel in ways that contradict, rather than serve, their beliefs.

This dissertation will focus on a smaller city, which is less common in planning research, although these areas often see higher proportions of car trips than larger counterparts. Station types will be explored as well: while Oxford city centre is more typical of urban environments, parkway stations like OP are standard for suburban railway design, thus offering relevance to this dissertation's findings. Finally, the Covid-19 pandemic will be considered, given its unprecedented implications for modern mobility.

## 3. Methodology

The primary data collection method used in this dissertation was a survey for statistical, descriptive and exploratory analysis. The following subsections will provide an overview of its design and interpretation. Ethics and limitations will also be noted.

### 3.1 Survey questionnaire design

A questionnaire was used to collect data for the survey. Responses were not compulsory, and many questions offered a 'No opinion' option. The questions were written in simple English for reach and clarity. The survey targeted Oxford residents who had made an access trip to either CSL in the three months leading up to the national lockdown on 23 March 2020. The time period was chosen to ensure accurate recollection, whilst garnering enough responses.

The questions were divided into four sections: attitudes; BE; travel experience; and policy interventions. The survey asked 50 questions (Appendix 1), starting with household characteristics and 'typical' trip aspects, which determined CSL and mode. Respondents were also asked to provide a 24-hour travel diary (before lockdown). The survey landing page debriefed respondents on research intent, as well as anticipated completion time, which was kept below 20 minutes for responsiveness (Appendix 2, Fig. 1). Three individuals piloted the survey to test legibility; several amendments were then made to images and wording.


*Fig. 1. Landing page of survey (Source: Author)*

To test for cognitive dissonance, attitudes were measured through various means. Several declarative statements regarding sustainability and travel decisions, which were partially adopted from surveys conducted by Steg (2005) and UCL (2014), gauged opinions along a scale of 'Strongly Disagree' to 'Strongly Agree.' 'Preferred' modes were then given specific sets of statements to assess self-perception.

For BE, *distance* was determined by stated measurements from the respondent's home to the CSL, and nearest 'town centre.' *Diversity*, *density* and *design* further supported questions of observed scenery, and the number of intersections encountered. *Destination accessibility* was explored through the opinions of the car and cycle parking at home and the CSL, as well as the distances mentioned. Respondents were asked to voluntarily provide home and work postcodes, which were later tested against the '5D' model.

TS was measured through typical trip duration, and satisfaction with time, cost and overall experience. Subjective well-being was measured using five emotions-based indicators (e.g. "rushed" vs. "relaxed") partially developed by UCL (2014). Walkability and cyclability was gauged by perceived safety and duration, and the number of roundabouts encountered. Traffic levels were judged on a low-medium-heavy scale.

Offered hypothetical last-mile interventions (e.g. segregated cycle lanes; paratransit) based on actions taken by other cities, respondents were then asked how likely they'd change their mode choice if implemented.

### 3.2 Data collection

Given that face-to-face contact was legally discouraged during lockdown, the questionnaire took the form of an online-only survey. It was built on the Opinio platform, which assured professionalism and legitimacy amongst respondents, and distributed via multiple avenues.

The author, who lived in Oxford at the time, notified networks at the University of Oxford, and beyond. The survey was circulated amongst visible groups on social media platforms like Facebook and Twitter, which proved most effective for outreach. Offline, the author displayed ten posters on community notice boards across Oxford, which included a QR code to the survey (Appendix 3). The author also encouraged respondents to share the survey; the use of the snowballing technique helped reach populations not regularly online, or communicable by other means (Hickman, 2017).

The survey was open for two weeks, between 11 May and 28 May 2020. The author gathered 107 responses for Oxford and 29 for OP, or 136 responses in total.

### 3.3 Statistical approach

Once finalised, the survey data was 'cleaned' and exported to SPSS. Relevant string variables were given dummy variables (Appendix 4). To measure *density*, postcodes were assessed at the area level (e.g. OX2), the most localised measure of the UK Census (Office for National Statistics, 2011), and categorised on a scale created by the author (Appendix 5). *Diversity* was tested through categories of 'job density' (population divided by employment). The author used Google Maps Street View to label postcodes with *design* types. Pricing was categorised by the average user cost for each mode, including parking.

Logistic regression was conducted in two parts: for household characteristics, and categorical data pulled from attitudinal and TS questions; and for BE factors. The CSL was held as the independent variable, and the mode choice as the dependent variable. Mode choice was streamlined into two categories: 'non-car,' (e.g. walk, cycle, public bus, cycle-hire) and 'car' (e.g. driver, passenger, rideshare, taxi). Averages for each question were listed, and *p-values* were weighed by and between station choice. The null hypothesis being that none of the factors affected mode choice, the results were measured against *p-tests* of $<0.05$ and $<0.01$.

### 3.4 Descriptive and exploratory approach

The log regression signified relevant crosstabs to further dissect with qualitative analysis. Survey respondents were also asked if they were interested in a 15-minute follow-up interview. Ten respondents randomly picked for a semi-structured interview in late May and early June 2020 helped deepen findings, and balance demographic discrepancies (Appendix 6).

The 'Healthy Streets' criteria was deployed at both CSLs (Appendix 7), which was created by Transport for London, Matthew Carmona and other UCL faculty (2018) for designers and planners to judge street improvement proposals. The set of 31 questions is based on design aspects affecting travel experience, offering a score from 0 to 100. Relevant crash and traffic data publicly available from Oxfordshire County Council (OCC) were utilised, and survey findings were paired with interviews from local transport planners.

### 3.5 Ethical considerations

The survey was voluntary, anonymous and confidential, thus minimising the risk posed to participants (Appendix 8). Carrying no incentive, participants were informed that the data would strictly be used for research. The use of Opinio assured guidance under UCL's data encryption protocols; additionally, Microsoft Teams, which issues copies of recorded sessions to all parties, offered sufficient levels of transparency for interviews.

### 3.6 Limitations

The Covid-19 pandemic posed immense research challenges. Due to the shelter-in-place order from March to June, it was effectively impossible to conduct in-person interviews or outreach at CSLs. This lack of oversight increased the likelihood of online respondents misinterpreting questions or exaggerating opinions, which the follow-up interviews sought to address. Furthermore, psychosocial disruptions may have impacted respondents' recollections pre-lockdown, which is significant when studying memories of trips taken. (The 'Healthy Streets' check, however, was based on pre-lockdown site visits.)

Several BE factors were not weighed for respondents who did not offer postcodes, which limited the sample by about 20. Furthermore, postcode areas may not reflect hyper-local realities, which are significant in last mile conversations. The survey response rate could be considered 'low power,' given the ratio of OP and car users; however, disparities match respective station ridership levels. There also lied the potential for selection bias: including 'sustainable' in the survey title may have attracted certain respondents over others.

## 4. Research Findings

The following section presents the analysis results, first considering site context and demographics.

### 4.1 Site context

Both CSLs are located within the county of Oxfordshire, about 60 miles north from London. The divergent modal shares and contrasting designs led the author to choose these sites (Fig. 2).

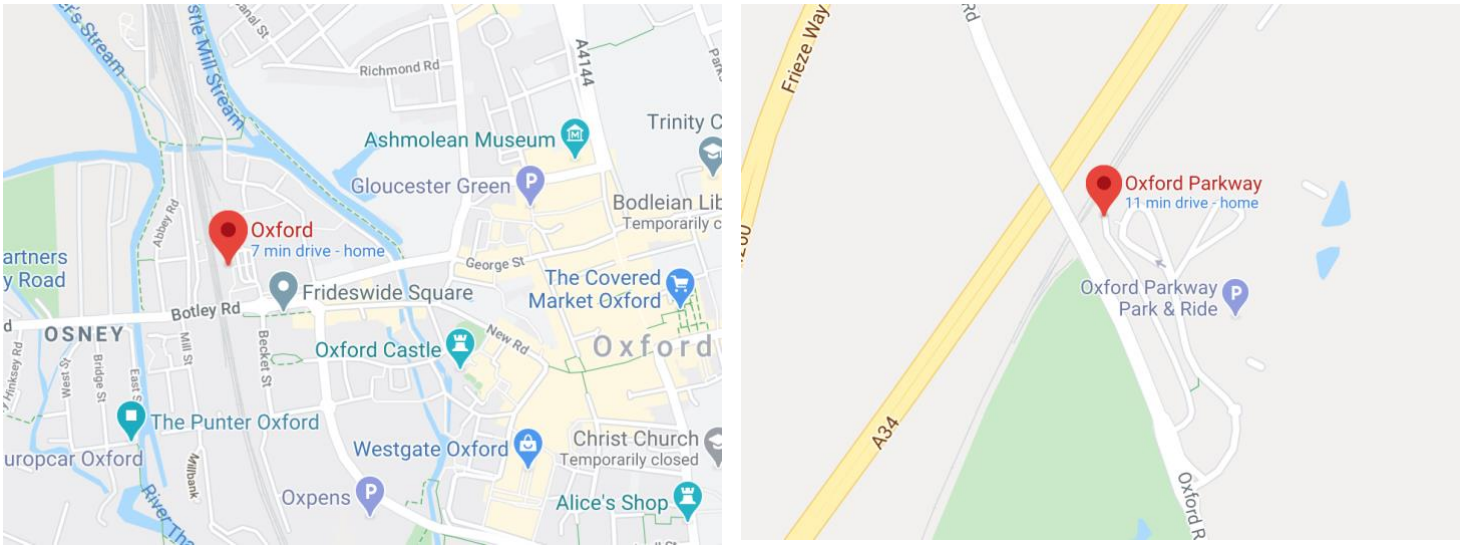


*Fig. 2. Map view of both stations (Source: Google Maps)*

First opened in 1852, the Oxford station is a 10-minute walk from the city centre; a result of the university's concern that the railway might undermine the city's academic nature (Koenig, 2010). The city recently redeveloped nearby Frideswide Square, adding traffic calming layouts at roundabouts, direct cycle routes, and expanded cycle parking. In addition to London's Paddington station, trains run by multiple operators reach Birmingham and Manchester, among other sites. Due to capacity expansion and sustained growth, the Oxford station saw its highest annual usage in 2018/2019, with 8.2 million passengers — over two million more than four years before (Office of Rail and Road, 2020).

*Fig. 3. The entryway to both stations (Left: Oxford; Right: OP) (Source: Google Maps)*

Comparatively, OP is newer. Prime Minister David Cameron attended the station's opening in 2015, with service first to London's Marylebone station, and then extended south to Oxford one year later. It is operated by Chiltern Railways, and located at the northern edge of Oxford in Water-Eaton, a narrow Green Belt wedge near the suburbs of Kidlington and Summertown. Intended for residential and economic development, the station is about 6.2km north of the Oxford rail station (Fig. 4). Annual usage has increased every year since opening; in 2018/2019, 1.1 million entries/exits were recorded (Ibid, 2020).


*Fig 4. Map view of distance between stations (Source: Google Maps)*

Abutted by a Park & Ride, OP was explicitly presented as a site with wider catchment due to its cheap, abundant parking, costing less daily than the Didcot Parkway station at £4 rather than £7 (Steer Davies Gleave and DfT, 2018). Surveys suggest car access at OP is between 60 and 80 percent, and less than 10 percent at Oxford (Ibid, 2018; Headicar, 2020a). With a smaller sample, this dissertation found that car access is 44.8 percent and 3.8 percent, respectively.

The survey pool's demographics were compared to both Oxfordshire, and England/Wales, for national implications (Table 1).

| Category | Survey Pool | Oxfordshire | England & Wales |
|---|---|---|---|
| Gender | **63%** female; **35%** male | **50%** female; **50%** male | **51%** female; **49%** male |
| Ethnicity | **79%** white; **21%** non-white | **84%** white; **16%** non-white | **80%** white**; 20%** non-white |
| Average Age | **26-35** years old | **40.1** years old | **40.2** years old |
| Median Income | **£30,000 to £60,000** | **£33,802** | **£30,400** |
| Employment Rate | **87.5%** | **85.2%** | **76.5%** |
| Education | **93%** graduate; **7%** secondary school | **54%** graduate; **26%** secondary school | **45.5%** graduate; **29%** secondary school |

*Table 1. Summary of survey, county and national demographics*

The ethnicity, median income and employment rates were statistically similar. However, gender, average age, and education had discrepancies, which could have resulted from sampling methods; Oxford tends to be more female, young, and well-educated than the rest of the county and country. There were no notable differences by station, although Oxford predictably saw a larger student population.

### 4.2 Quantitative analysis

#### 4.2.1 How statistically significant are household characteristics, attitudes and travel satisfaction on mode choice?

| | Avg for Oxford | Avg for OP | p-value Oxford vs. OP | p-value Oxford | p-value OP |
|---|---|---|---|---|---|
| *Mode choice (non-car vs. car)* | **1.13** | **1.40** | N/A | N/A | N/A |

| | | | | | |
|---|---|---|---|---|---|
| *Individual characteristics* | | | | | |
| Gender | 1.66 | 1.69 | .405 | .198 | .978 |
| Age | 2.30 | 3.31 | **.002 | .121 | .429 |
| Education | 1.95 | 1.86 | **.008 | .999 | .999 |
| Employment | 3.70 | 3.65 | .330 | .777 | .345 |
| Income | 1.99 | 2.25 | .243 | .137 | .494 |
| Children at home | 1.17 | 1.21 | .571 | .709 | .775 |
| Household size | 2.39 | 2.24 | .794 | .254 | .202 |
| Housing type | 3.64 | 2.69 | .078 | .589 | .276 |
| Housing situation | 2.45 | 3.03 | .354 | .875 | .685 |
| *Attitudes (1-5; >Agree)* | | | | | |
| Likes to travel | 3.04 | 2.52 | **.006 | .557 | .231 |
| Enjoys the commute | 3.01 | 2.55 | .112 | .051 | .751 |
| Pro-sustainability | 4.45 | 4.55 | .470 | .107 | *.040 |
| Environ influences, but still pro-car | 2.18 | 3.10 | **.000 | .100 | **.005 |
| Environ doesn't influence | 2.36 | 2.48 | **.002 | *.026 | *.011 |
| Environ has big role in decisions | 3.50 | 3.52 | .444 | .691 | .168 |
| My travel has little environ impact | 3.94 | 2.86 | **.008 | .755 | .088 |
| Mostly use PT | 3.22 | 2.97 | .443 | .502 | .642 |
| Never car | 2.69 | 1.76 | *.015 | .113 | .320 |
| Individual actions don't matter | 2.74 | 2.48 | .749 | .455 | .933 |
| Willing to walk/cycle more | 3.75 | 3.97 | .944 | *.013 | .847 |
| Willing to use PT more | 3.53 | 3.69 | .637 | .054 | .511 |
| Cars are too expensive | 3.41 | 2.69 | **.027 | **.036 | .991 |
| Don't mind traffic | 1.69 | 1.97 | *.019 | .091 | *.022 |
| PT is unreliable | 3.00 | 3.10 | .126 | .216 | .095 |
| Usual mode (non-car vs. car) | **1.12** | **1.55** | **.002 | .071 | .620 |
| Preferred mode | **1.10** | **1.21** | *.031 | *.021 | .810 |
| *Travel satisfaction* | | | | | |
| Trip time | 1.49 | 1.28 | .585 | .525 | .373 |
| Commute time satisfaction | 3.23 | 3.24 | .437 | .978 | .190 |
| Commute cost satisfaction | 3.37 | 3.41 | .896 | .795 | .874 |
| Mood: | | | | | |
| Rushed <> Relaxed | 2.92 | 3.48 | .140 | .791 | .217 |
| Concerned <> Confident | 3.48 | 3.72 | .532 | .697 | .226 |
| Stressed <> Calm | 3.16 | 3.66 | .327 | .556 | .387 |
| Tired <> Lively | 3.43 | 3.17 | *.049 | .901 | .278 |
| Bored <> Engaged | 3.29 | 3.52 | .980 | .458 | .825 |
| Neighbourhood satisfaction | 3.36 | 3.14 | .213 | .052 | .718 |
| Overall satisfaction | 2.89 | 2.97 | .461 | .439 | .844 |
| Walk experience | 3.56 | 2.66 | **.000 | .191 | .061 |
| Walk time | 2.22 | 2.45 | .059 | .608 | **.002 |
| Cycle experience | 2.66 | 2.31 | *.023 | .224 | .138 |
| Traffic level | 1.36 | 1.59 | .711 | .712 | .224 |
| # of roundabouts | .877 | .893 | .961 | .635 | .395 |

*Table 2. Regression analysis of individual characteristics, attitudes & TS (* for <.05; ** for <.01)*

Two individual characteristics significant when testing between stations were age and education (Table 2). OP users leaned older than Oxford users, averaging 36-50. However, the two respondent pools were similar

in education (tended 'graduate'), demonstrating that this aspect can cut both ways: towards vehicular *or* non-vehicular behaviours.

Intriguing correlations start to form with attitudes. Oxford users had little opinion towards being 'pro-travel,' while OP users tended to disagree, as commuting and travelling sparked less interest amongst a more car-dependent audience. The statement was significant when weighing between stations, or in both settings. Yet interestingly, OP users tested higher for a 'pro-sustainability' attitude, which yielded relative significance on their mode choice — the first glimmers of cognitive dissonance.

As sustainability gradually related to personal behaviours, results complicated. The statement 'Environment influences my travel decisions, but I still take the car most of the time' was extremely significant between stations. Yet OP users were more likely to have no opinion on the matter and disagree slightly with 'Environment doesn't influence my decision-making at all,' both of which correlated significantly with mode. Oxford users similarly disagreed, but it yielded less significance. Evidently, most respondents say they want to live sustainably, but that desire factors less into suburban daily decision-making.

OP users were less likely to say they never use the car than Oxford users, but accounting between stations, the statement yielded significance. Being more likely to walk or cycle if facilities improve was significant on Oxford users' mode, perhaps signifying that less car-dependent users tend to more regularly consider active travel options. Telling of attitudes, these users are more likely to believe cars are too expensive, which also yielded significance. But unsurprisingly, users at both stations overwhelmingly said they disliked sitting in traffic.

At both stations, last mile modes were reflective of regular travel behaviours; in fact, for OP users, cars are even more represented in usual activity, emblazoning a general car-prone tendency. Yet consequently, OP users preferred non-vehicular over vehicular modes, even if they didn't regularly use them. It's worth noting this trend and interest in change for later discussion, as both held significance between stations.

Importantly, the safety of the 'walk experience' (which will be explored as 'walkability') was seen more favourably by Oxford users than OP users, who had a slightly negative opinion, but in both settings, it held immense significance on mode choices. While the walk time was about the same for either station (15-30 minutes), it yielded an outsized effect on OP users' mode. The same sentiments could be said about 'cycle

experience,' which was seen as slightly more unsafe at OP than Oxford, but yielded significance between stations. This paradox will be further discussed shortly.

### 4.2.2. Which BE factors are statistically significant on last mile decisions?

| | Avg for Oxford users | Avg for OP users | p-value Oxford vs. OP users | p-value Oxford users | p-value OP users |
|---|---|---|---|---|---|
| Mode choice (car vs. non-car) | 1.13 | 1.40 | N/A | N/A | N/A |
| *Density* | 2.58 | 1.81 | .001** | .407 | .798 |
| *Diversity* | | | | | |
| Job density | 2.05 | 2.18 | .078 | .415 | .444 |
| *Design* | | | | | |
| Street design classification | 2.57 | 1.78 | .055 | .337 | .622 |
| # of intersections encountered | 3.31 | 3.00 | .724 | .173 | .731 |
| *Destination accessibility* | | | | | |
| Cars available | .613 | 1.48 | .000** | .268 | .035* |
| Bikes available | 1.62 | 1.76 | .054 | .046* | .187 |
| Average trip cost | 1.38 | 1.93 | .001** | .001** | .601 |
| **Parking**: | | | | | |
| Avail. home car parking | 1.52 | 1.21 | .459 | .937 | .332 |
| Avail. home cycle parking | 1.16 | 1.07 | .828 | .999 | .999 |
| Safe home cycle parking | 1.25 | 1.07 | .388 | .988 | 1.00 |
| **Parking atts: (1-5; >Agree)** | | | | | |
| **Home car parking atts:** | | | | | |
| Close to home | 3.81 | 2.93 | .741 | .595 | .668 |
| Space for residents | 3.39 | 3.41 | .834 | .892 | .515 |
| Space for visitors | 2.92 | 3.24 | .442 | .511 | .419 |
| Reasonable cost | 3.47 | 3.48 | .915 | .407 | .283 |
| Overall satisfaction | 3.37 | 3.59 | .694 | .822 | .728 |
| **Home cycle parking atts:** | | | | | |
| Close to home | 3.47 | 2.86 | .438 | .060 | .368 |
| Space for residents | 3.11 | 2.55 | .325 | .118 | .968 |
| Space for visitors | 2.85 | 2.62 | .509 | .194 | .809 |
| Reasonable cost | 3.65 | 2.76 | .165 | .027* | .517 |
| Overall satisfaction | 3.01 | 2.66 | .526 | .125 | .728 |
| **Station car parking atts:** | | | | | |
| Space for me | 2.83 | 3.66 | .010** | .368 | .760 |
| Reasonable cost | 2.63 | 3.34 | .157 | .806 | .920 |
| Overall satisfaction | 2.74 | 3.62 | .023* | .568 | .988 |
| **Station cycle parking atts:** | | | | | |
| Space for me | 2.72 | 2.93 | .422 | .356 | .421 |
| Reasonable cost | 3.62 | 3.38 | .058 | .082 | .087 |
| Overall satisfaction | 2.84 | 3.10 | .847 | .259 | .287 |
| Safe to leave my bike | 2.34 | 3.07 | .393 | .373 | .333 |
| *Distance* | | | | | |
| Distance to station | 2.05 | 2.10 | .117 | .514 | .223 |

| | | | | | |
|---|---|---|---|---|---|
| Distance to town centre | 1.39 | 1.45 | .357 | .209 | .929 |

*Table 3. Regression analysis of BE factors*

Oxford users tended to live in more dense environments than OP users, yet only between stations did *density* hold high significance over mode. Additionally, *diversity*, *design* and *distance* yielded minimal significance (Table 3).

Oxford and OP users tended to live similar distances to stations and town centres but chose divergent modes to travel them. As shown (Fig. 5), OP has a much larger catchment than Oxford, attracting drivers who sometimes live closer to Oxford. Several OP users even lived closer to OP than some Oxford users did to Oxford, yet the latter rely more on cycling or public bus. Even users with longer distances (5-10km) cycle to Oxford. This signifies that distance to the station correlates with mode in suburban settings only when below 1km; more than 1km, travel behaviours diverge from urban counterparts, notably towards the car.

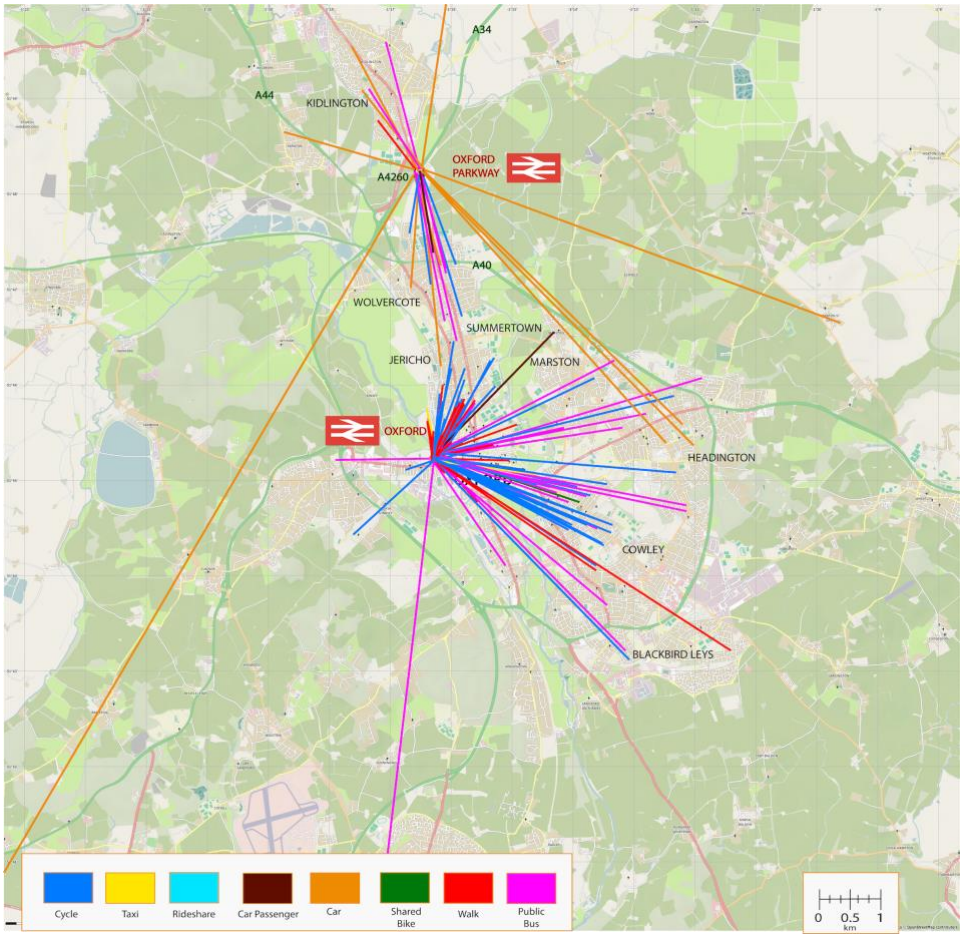


*Fig. 5. A map of journeys made to CSLs by postcode and mode (Source: Author)*

In line with BE research, *destination accessibility* yielded the most significance. The availability of a car was immensely significant between stations, and particularly significant for OP users: they often had more than one car available to them, while Oxford users had less than one. With cycling, OP users unexpectedly had more bikes at home than Oxford users, but less regularly used them for utility. Accessibility was amplified in divergent ways: for Oxford users, having a bike heavily correlated with non-vehicular travel behaviour; for OP users, having a car heavily correlated with vehicular travel behaviour.

Another notable theme is cost. Users at both CSLs tended to pay little for their trip; on average, the cost was between £1 and £5 (Fig. 6) but it resulted in different travel behaviours. In both settings, the cheap trip cost held a near-precise significance over mode choice; thus, pushing more users towards the car in OP, and more users towards sustainable modes in Oxford. Yet it yielded more significance at the latter.

*Fig. 6. Drivers pay £4 to park all day at OP (Source: Author)*

It's worth noting that parking attitudes stemmed from awareness: users' breadth of knowledge seemed limited to their own usage, and different aspects mattered to different people. Oxford users slightly agreed that their cycle parking at home came 'at a reasonable cost,' which yielded significance over mode. In both settings, the car space available and overall satisfaction with said space (slightly more than neutral) was significant as well. The role of parking — particularly with cost — will be further explored through qualitative data.

### 4.3 Qualitative analysis

#### 4.3.1 How do perceptions of walkability and cyclability affect travel?

In 2019, Oxford commuters were deemed the sixth most stressed in the UK (Roberts, 2019). Amongst respondents ages 25 to 34, nearly 75 percent said that their commute affected stress levels. Noting TS, the strong feelings held will be explored in relation to walking and cyclability vis-à-vis the CSLs.

The first factor considered was traffic. All OP users must travel along Oxford Road, which is bisected by two bypasses. From the station's opening in 2015 to 2018, daily traffic levels have increased from 17,200 to 18,700 (Oxford City Council, 2020), indicating that the station and adjacent Park & Ride have heightened local traffic. Cutteslowe Roundabout, at its southern entry point, has also seen daily traffic rise, from 14,100 (2015) to 14,900 (2018).

At Oxford, most users approach from the west, along Botley Road, or east, along Frideswide Square. Cyclists and pedestrians have an additional segregated path north, from the Oxford Canal. The underpass connected to the station, on Botley Road, has seen daily traffic increase from 11,400 (2015) to 13,600 (2018). Oxpens Road, an artery to Frideswide Square, has seen traffic decrease from 15,800 (2016) to 15,500 (2018). While substantial, these figures are notably less than Oxford Road, which has an outsized effect on walkability and cyclability as the *sole* road leading to OP.

The next factor to consider is perceived safety at roundabouts. OP has four within a 3km radius: Kidlington, Cutteslowe, Wolvercote and Woodstock. The two closest to the station (Kidlington; Cutteslowe) had the highest crash rate of the four (CrashMap, 2020). Between 2016 and 2018, Kidlington Roundabout saw 13 crashes, two of which were labelled "serious," involving hospitalization, and eight with cyclists. Cutteslowe Roundabout saw eight crashes, two with cyclists and one involving a pedestrian.


*Fig. 7. Frideswide Square after redesign (Source: Google Maps)*

Roundabouts and junctions in Oxford have recently undergone "upgrades," after statistics showed that Cowley Roundabout was the second most dangerous in the country between 2009 and 2015 (Oxford Student, 2017). Frideswide Square received a traffic calming improvement in 2015, which condensed the junctions near the station into small traffic circles (Fig. 7; Oxford Mail, 2015).

Between 2015 and 2018, the circle outside of the station saw eight crashes, four involving cyclists. Another nearby circle (Hollybush Row) saw seven crashes between 2016 and 2018, six of which involved cyclists, with one labelled "serious." Although Oxford roundabouts had similar crash rates to OP, aside from Kidlington, visitors to the latter must pass through roundabouts that have little or no traffic calming features, while Oxford users have alternative routes.

Utilising these data sets, amongst others, this dissertation performed the 'Healthy Streets' check on Frideswide Square (Oxford) and Oxford Road (OP), which garnered scores of 68 and 42, respectively. Frideswide Square scored highest for 'places to stop and rest'; 'things to see and do'; and 'people feel relaxed'. Oxford Road scored lowest for 'places to stop and rest'; 'easy to cross'; and 'not too noisy'. According to guidelines, the higher grade for Frideswide Square resulted from ample sitting area, slower traffic speeds, and the presence of 'eyes on the streets' to make visitors feel safe (Jacobs, 1961). Similarly, what dragged down Oxford Road's score were higher traffic speeds, minimal shared space for walkers and cyclists (Fig. 8), as well as noise and air pollution, which is above the legal limit at Cutteslowe Roundabout, the nearest testing site (Oxford City Council, 2020).

*Fig. 8. "Shared" pedestrian-cycle track on Oxford Road (Source: Author)*

Analysing by specific mode offers a fuller portrait of TS, and perceptions held towards certain modes. Walkers (31) were "completely" satisfied with trip time and cost, and "somewhat" satisfied with overall experience. Tracking with prior research, walkers were the only user group to say they feel "very satisfied" with their neighbourhood. Most say walking and cycling is "largely safe." The usual traffic level experienced was split, and most passed at least one roundabout.

Cyclists (52) vocalised similar satisfaction for trip time, cost and overall experience. However, they were more likely than walkers to say they were more stressed, lively and engaged. Most said that walking is "largely safe," but would take over 30 minutes, and that cycling was also "largely safe." They said they experience high traffic and at least one roundabout — stressors they have evidently accepted in their commutes.

Most private car drivers (14) say they are "somewhat satisfied" with trip time and overall experience, and "completely satisfied" with cost. They were more likely to feel relaxed but had middling feelings towards other emotions. Drivers held the most negative opinions towards walking ("largely unsafe") and cycling ("relatively" or "largely unsafe") and said walking would take over 30 minutes. They also saw high traffic and at least one roundabout.

(Herein lies a concurrent factor of gender: most car drivers at OP were female. Research shows that female users typically factor in issues of perceived safety more than male users do while walking and cycling [Allatt, 2018]. This is a particularly vivid example of individual characteristics overlapping with attitudes and TS.)

Bus riders (32) were the only user group to say "somewhat satisfied" with trip time, cost and overall experience, and that the typical commute takes 15-30 minutes (other groups reported 5-10 minutes). Riders said they felt more rushed and stressed, with tepid feelings in other categories. Walking, they said, would be "largely safe," but take over 30 minutes — a definite hindrance. However, views towards cycling safety were more divided, between "relatively safe" and "largely unsafe." Most also experienced heavy traffic and at least one roundabout.

TS elements dominated follow-up interviews. A keyword was "pleasant," both with positive and negative connotations. Aligning with past research, one subject who walked to Oxford along the canal towpath expressed idyllic feelings, which included sightings of swans and cygnets: *"It's heaven not to have any traffic... The natural world, you breathe easily, and you don't mind going [into] London."* (Interview 1)

Two subjects who cycled to OP exhaustively detailed their journey conditions. One recalled:

> *"I turn left onto what is the pedestrian-cycle path* [Fig. 7]*, depending if there are pedestrians there. I must keep my eye out, so I don't knock into any of them. There might be shrubbery; I found a couple of times that if I wasn't wearing glasses, I might've been hit in the eye… There's a drain that often floods, so there's this massive puddle. If you're not careful, and avoid it to go onto the road, you could be hit by 40-50 mph traffic."* (Interview 2)

A subject who cycles to Oxford said they experience significant stress on Cowley Road, a main thoroughfare in south Oxford. The street has "*insufficient space*" for cyclists, and kerb extensions land cyclists behind bus and "*racer*" car exhausts. *"I end up doing things that I shouldn't do, like ignoring the pedestrian crossing, just so I can get ahead of the traffic,"* they said (Interview 3). The stress is compounded by heavy city centre traffic, and inadequate cycle parking at home and the station, which has led the respondent to miss their train.

Those who drove repeatedly mentioned "convenience." One subject who drives to OP said:

> *"Coming home from work, I literally can get straight in the car, and I'm home in 20 minutes. Cycling isn't that much different. But waiting for a bus, it's just painful and you can't be bothered at the end of the day."* (Interview 4).

They enjoyed the cost compared to bus fare, with cheap parking at OP. (It is £4 to park all day, compared to £2.80 for a single bus ticket, and £4.30 for a return.) The same subject said that the cycle track is "*horrendous*," with overgrown shrubbery, poorly shared space, and intense traffic. *"I do want to cycle. I think the thing that puts me off is the cycle track,"* they said. Yet cycling, they said, was just as conveniently grab-and-go as the car.

For bus riders, reliability reigns supreme. *"There have been a couple of times when I've waited 30 or 40 minutes for a bus that's meant to come every 20 minutes,"* said one rider to Oxford *(*Interview 5). They also said the trip was costly for the distance; something echoed by several other subjects who didn't take the bus. When considering other modes, experiential elements were make-or-break. Another rider to Oxford said:

> *"I like walking, yeah. It's just no fuss: you just have your two feet and legs… I like cycling as well, but I don't actually feel as motivated to do that, because it's a hassle sometimes."* (Interview 6)

But stressors weren't felt universally. Contrary to others, another subject who cycles to OP said the cycle track was "*straightforward*" and "*fast*" (Interview 7). They also reported that they drove in bad weather, or if returning late; the others did not. (Perhaps having that option changed immediate perceptions.) A bus rider to Oxford, with similar journey times as the riders mentioned, said they didn't mind the trip time: *"I'll just read a book… I think my travel priorities are elsewhere"* (Interview 8).

### 4.3.2 To what extent does cognitive dissonance exist between attitudes and behaviours?

As shown earlier, similarly held attitudes do not produce the same behaviours, thus provoking a degree of cognitive dissonance to explore. Starting with age, each group tended to generally like travel, but younger groups said the commute is an important part of their day. All groups said they strongly agree with wanting a 'sustainable lifestyle,' but only Gen Z (18-25), Millennials (26-35), and Baby Boomers (65+) said they were more likely to weigh their travel's environmental cost, and not drive as a result.

Gen Z were the most likely to say they 'never' take a car, and along with Millennials, that owning a car is too expensive, a feeling that dissipates as age increases. Yet the same groups were the most likely to say PT was unreliable, and systemic action is more impactful than individual; Gen Y (36-50), Gen X (51-65) and Baby Boomers had varied opinions on both. Every group said they didn't enjoy traffic; would walk, cycle or use PT more if facilities improved; and preferred cycling. (Except Gen Y, which preferred walking.)

When controlling for income, disagreements arise in car usage. Higher-income respondents (>£100,000) were less likely to say they weigh their travel's environmental cost, and not drive as a result. Along with medium-high respondents (>£60,000), these groups also were less likely to say they mostly walk and cycle, take PT, and never drive. Low-income respondents (>£30,000) were the most likely to say that owning a car is too expensive. However, all income levels generally had a positive view of PT; disliked traffic; would walk, cycle or use PT more; and preferred cycling.

(Although education levels were not sufficiently represented, it's worth noting that those with secondary education, albeit a small sample, leaned pro-car. They were less likely to say that the environment affected decision-making; walk and cycle most of the time; and never drive. While graduate respondents' preferred cycling, those with secondary education preferred walking or driving.)

The most notable attitudinal variances were mode-based. Walkers and cyclists were most inclined to like travelling, and say the commute is important to them. Surprisingly, both walkers and drivers were more likely to say environmental concerns did not influence their travel, but drivers also said the environment was important in decision-making. This potentially signifies that travel is not perceived as one with environmental value, which could be enabling cognitive dissonance.

Instilled habits are further evident. Walkers preferred walking; cyclists preferred cycling; and drivers preferred driving. Only bus riders did not prefer buses, but rather walking or cycling. However, riders were the most likely to still use PT, with walkers second, although the latter perceive PT as more reliable than the former. (Perhaps because they can walk.) Drivers were less likely to say owning a car is too expensive, and more likely to say they take the car most of the time.

This corresponded with respondents' travel diaries, which indicated that mode choices have chilling effects. Those who introduce a car into commutes at any point were more likely to see it "leak" into other activities; similarly for walking and cycling. Non-vehicular users were more multimodal, often combining walking, cycling and bus. Drivers more often rely on one (car) or two (car and train) modes for utility; if walking or cycling, it's often for leisure.

Contours of constructed identities are apparent in preferences. TS, again, was crucial: walk-preferred (38) said walking is relaxing, a source of exercise, and a time to think and listen to music. They also strongly identify as 'walkers.' They enjoy walking's cost-free nature, but do not agree that it saves time — the free

cost and experience matter most. Cycle-preferred (69) echoed similar sentiments, but independence dominated: they overwhelmingly agreed that cycling isn't dependent on anyone; that they can choose their own route; and thus cycling "makes life easier." Saving time was an important factor to this group, although they identified as "cyclists" slightly less, perhaps due to the caricatured cyclist in popular culture.

Bus-preferred (10), which dropped significantly from those who commute via bus, generally enjoyed the overall experience. This group saw it as safe and a time to think or listen to music but diverged in agreement over cost- and time-savings. Again, short-term perceptions mattered in forming longer-term attitudes.

Finally, car-preferred (13) correlated less with psychosocial factors of 'car fixation': they largely disagreed that they wanted a nice car, or that cars were a part of their personality. Feelings were split over whether they found it relaxing, yet like cyclists, convenience was key: drivers strongly agreed that they can choose their own route; didn't have to rely on anyone else; and thus driving "makes life easier." Protection against weather was also significant.

When testing for residential self-selection, the only notable factor found was 'proximity to the train station': only drivers were not likely to say that it was important. Bus riders were most likely to choose 'access to the public transit network' as a factor in choosing their neighbourhood, with walkers second. Those who cycle or drive also did not choose their neighbourhoods for reasons that match travel behaviours; relatively few cyclists noted 'access to the cycle network,' and same for drivers with 'access to the road network.'

Instead, liveability factors — i.e., access to shops and activities; 'a good environment' — were most popular across all modes. Personal situations also influenced decision-making: while several respondents said they wanted to be close to the university, one said the apartment building allowed pets, and another said they needed level access. Transportation was nowhere to be found in many people's choices, indicating that many users built their travel behaviours *after* they moved to a neighbourhood, rather than as a prerequisite.

In follow-up interviews, attitudes formed this bidirectional relationship with travel behaviours, informing people's decisions at the onset, then reinforcing their preferences later. But trip experience directly affected those initial perceptions. One subject painted a portrait of this entanglement:

> *"It's a combination of factors, right? If it was a shitty station that wasn't cheap to get to, it changes your perception of it. Then if you had an arduous journey to get there, maybe you'd just take [PT], because the bus is super quick. But it feels really annoying to pay 2.50 for a five-minute journey…"* (Interview 7)

Users also held attitudes that reinforced pre-conceived decisions. When asking one subject who cycles why they didn't drive, they replied: *"I couldn't even think of it! On environmental grounds, primarily"* (Interview 1). Two young subjects — one cyclist; one bus rider — didn't have driving licenses and were not considering them for climate reasons. These attitudes created a 'self-fulfilling prophecy;' once formed, users tended to justify their own means: *"I love cycling. It's clearly the most efficient, in terms of carbon emissions and time,"* said one subject. *"It's so predictable. I know in ten minutes, I can be standing on the platform"* (Interview 9).

Subjects then found it difficult to reconsider routines when confronted. The same subject, after bemoaning their cycling trip to OP, replied comfortably: *"It wouldn't stop me cycling, because I'm already cycling."* Another subject, who drives to OP but lives closer to Oxford, had to momentarily reflect: *"I could go from Oxford. The reason I don't normally do that… why don't I? I suppose I don't really think of it. Because OP opened before the line came into Oxford station, I just got into the habit of going there"* (Interview 10). Then it self-fulfils: the same subject voiced station comfort and travel hardships after the fact.

There were also larger social ramifications to consider. The subject above said that when OP opened, they knew several friends who had difficulty cycling, thus informing their own decision. A bus rider to Oxford said their partner encountered an aggressive taxi driver while cycling, which shaded their perception. A cyclist to OP said that they often hear negativity towards the trip: *"Whenever I talk to people, it's the unpleasantness of it. It's this very emotional reaction"* (Interview 2).

### 4.3.3 What are potential interventions for promoting a sustainable last mile?

In the case of the CSLs, expected growth and rail expansion (e.g. an east-west connector to Cambridge) heightens the urgency for sustainable last mile solutions (Steers Davies Gleave and DfT, 2018). Oxford's city centre is also set to become the world's first 'zero emission zone,' following targets under the Paris Climate Agreement (Jones, 2017). Considering these scenarios, OCC, the respective transport authority, has developed strategies to reduce car trips.

The county's transport plan targets 'short car trips' under 5 miles for active travel or PT — a category that befalls this dissertation's discussion (OCC, 2020). It aims to increase cycling in Oxford by 50% by 2031; an ambitious goal for a city where cycling hasn't risen significantly in years (Ibid, 2020). The plan — which highlights station trips as having 'multimodal' potential — puts forward eight 'pillars,' including a network of 'quick ways' and 'quietways;' lessening city traffic; and a 20mph speed limit. The interventions are intended for both new and regular cyclists.

The Covid-19 pandemic has since sped up implementation (Whitehead, 2020). OCC plans to install 'bus gates,' limiting car traffic near Oxford station; add cycle racks to 'Park & Ride' sites (including OP); and refurbish cycle lanes (OCC, 2020). The council was criticised after being denied 'active travel' funds from DfT for a "lack of ambition;" however, officials say more funding and action is imminent (Lynch, 2020).

Although e-scooters are now legal, most respondents said 'micro-mobility' would not change their behaviours; in fact, similar schemes in Oxford have failed (Ffrench, 2020). For most suggested interventions, a slim majority of respondents chose "Does not apply to me," thereby abstaining if perceived to affect a user group other than them. Yet the intervention that won widespread support was for the local council to "radically reshape" streets for sustainable modes, signifying a serious interest in the changes afoot.

Drivers were split in saying they'd switch modes if segregated cycle routes were introduced. A "better walking environment" drew less appeal, perhaps due to distance, as did TOD, which indicates domain satisfaction. But if better PT options were introduced, including paratransit, most drivers said they'd reconsider. (PickMeUp, an on-demand pilot, recently shuttered due to lack of funding. It didn't extend to OP. [Oxford Bus Company, 2020]).

But parking was hardly a panacea. Less than half of drivers said they'd switch modes if costs were raised at the station, while minimal credence was given to the cost of at-home parking, which is often internalised as a cost. (Although drivers said in interviews that it depended on the price jump.) Safer cycle parking also drew apathy. Yet coincidentally, at least half of drivers — and most OP users — supported a more radical council, which would enact changes they otherwise passed over.

Specific user demands were seen in interviews. A bus rider said the hill they live on in Headington (East Oxford) could be overcome by e-bike, if available (Interview 6), which tracks with previous research in Oxford (Jones et al., 2016). A walker said the bus would be more appealing if stops had cycle racks (Interview

1). The cyclist who missed trains due to parking said that more abundant (and safer) station facilities would be encouraging (Interview 3).

Two drivers cited station conditions at night as deterrents (Interviews 7, 10). Peter Jones, an Oxford-based engineering professor at UCL, said he heard similar sentiments in the nearby city of Reading. He quoted:

> *"In the morning, I'd love to go in on the bus: it's cheaper, frequent. But when I get back in the evening, it's an hourly service. I'm not going to hang around for an hour after dark, in the winter."* (Jones, 2020)

For drivers, the ease of being able to jump into a car and take off was unmatched by slow bus service. The 'liveliness' of the station — which includes design aspects of lighting and sight — mattered, Jones said. At Oxford, users are immediately greeted by buses, taxis and shops when they depart. Yet at OP, users must walk across the parking lot to a bus shelter to wait (Fig. 9). Meanwhile, taxis garner less interest with cheap all-day parking.

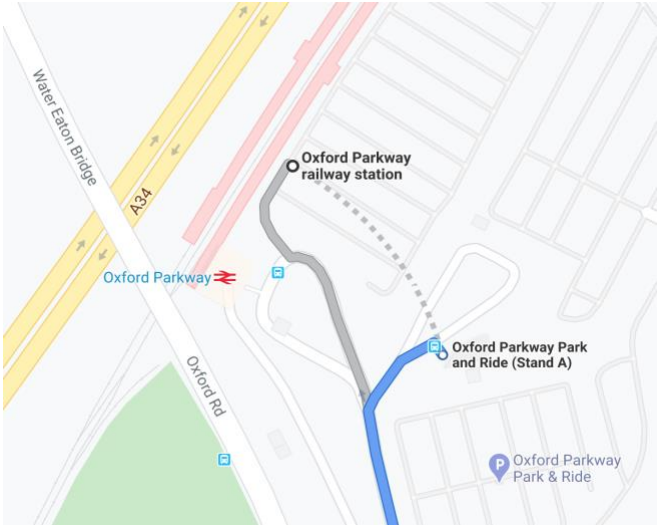


*Fig. 9. Map view of bus shelter's distance from station (Source: Google Maps)*

Echoing attitudinal findings, Jones argued that people perceive sustainability differently: some users may see it as walking and cycling, while others think electric vehicles (EVs). Personal incentives and public interests (e.g. OCC, Network Rail) diverge. *"Each person has their particular thing that they're interested in maximising. And they don't necessarily align with, or represent, what's in the public interest,"* Jones said. *"It's all about incentives."*

Peter Headicar, a transport planner formerly at Oxford Brookes University, said that last mile solutions must be conceived across authorities. OCC wants to promote walking or cycling, but Network Rail garners revenue from parking — a crucial part of OP's attraction (Steers Davies Gleave and DfT, 2018). *"There are different components of a journey, subject to different jurisdictions, which decide charging regimes,"* he said (Headicar, 2020b).

As these analyses have shown, travel is the result of constant complex decisions. Yet articulating the entire spectrum of factors consequential to the journey itself could shed light on measures that yield greater impact. Rather than a flowchart, Headicar described a "circular" web, with no starting or ending point:

> *"Do you start with attitudes, because that, in turn, might influence car ownership? For some, that's obviously not even in the scope of options. A bike is partially a function of practical circumstances, and whether it's cheap, but equally may affect attitudes to health. All these things are embedded in there. Different factors matter for different people. So, where do they start the circle?"* (Ibid, 2020b)

## 5. Discussion

This dissertation's quantitative analysis demonstrates that a variety of factors correlate with one's last mile mode. But notable significance between stations — thereby representing relevance in urban *and* suburban contexts — demanded a wider scope. Deepened by qualitative data, a more cohesive (and convoluted) picture arises, often unseen on paper, of travel behaviours that clearly do not fit into precise boxes.

Both approaches ultimately promote *four* general findings:

1. ***Attitudes are often detached from travel behaviours, as definitions vary.*** Larger concepts (e.g. 'sustainability') are not symmetrically paired with individual actions. Other factors are at play, some more complicated than others. For example, travellers talk, and shared experiences affect perception (a theme that should be explored in further research). TS is also personalized: a slog through traffic for one is podcast listening time to another. Attitudes, however, provide a roadmap of areas where users can be swayed.

2. ***The last mile is indicative of regular travel behaviours.*** Travellers typically use the same modes for the last mile and general activities. That could be explained by habit: travellers start to use one mode regularly, and then it overtakes other aspects of their routine — which, in a suburban context, is often the car. This finding places greater significance on the last mile, as it visibly resonates beyond trips to transit hubs.

3. ***There is no "silver bullet" solution; rather, push-pull factors must be focussed on.*** What may attract one user is not necessarily suitable for another, which weakens blanket interventions. Various elements of BE, TS, and attitudes lead to divergent outcomes for travellers, based on individual characteristics and experiences. It is notably more 'push-pull': users can be tempted towards ('push') or away ('pull') from certain modes. Therefore, honing minute details could create a template for sustainable shifts, as behaviours culminate from a series of granular decisions.

   And that template starts at home.

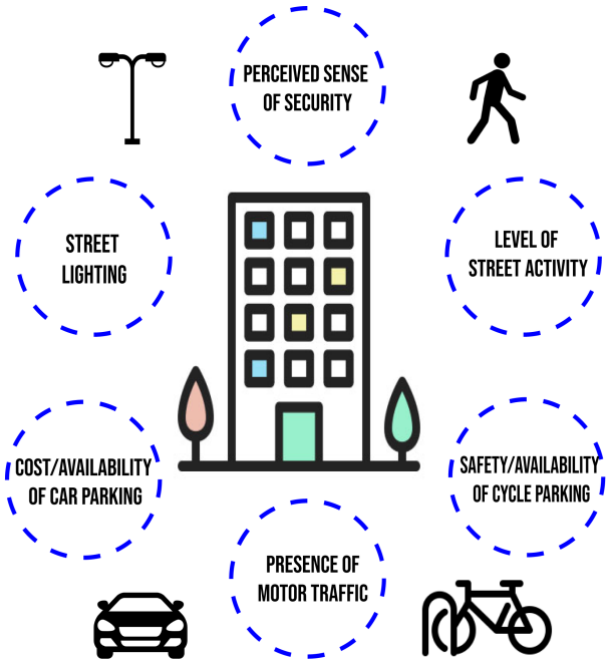


*Fig. 10. Push-pull factors at home (Source: Author)*

The home is a site of *availability* and *accessibility.* Having both free, safe and easy cycle parking is crucial — as is the price and availability of car parking. If users deem the latter more convenient, then that acts as a pull factor to car use. Upon arrival or departure, users are greeted by the design aspects of immediate surroundings, including lighting, street activity, and perceived security, which help shape one's sense of local mobility. While impact varies based on individual characteristics (i.e. gender; ethnicity), BE plays an outsized role at home, offering a 'first impression' of one's TS and the basis from which their attitudes, preferences, and habits emerge.

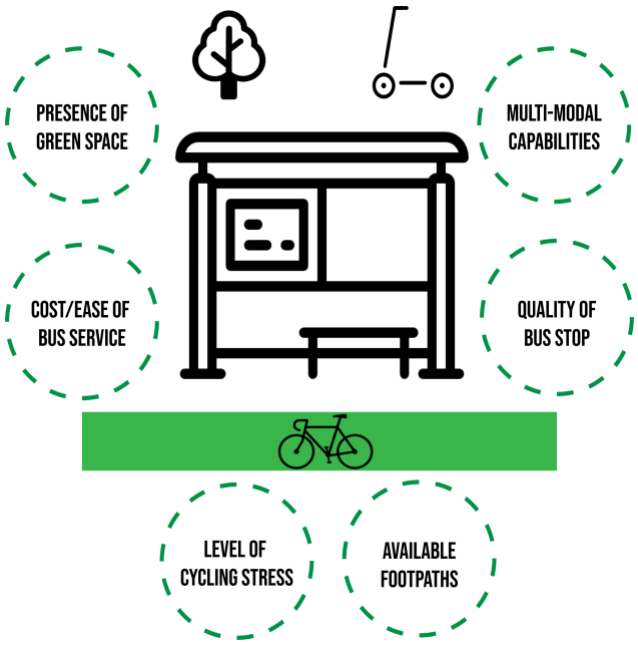


*Fig. 11. Push-pull factors along the journey (Source: Author)*

The journey is the most consequential phase, due to its multitude of micro-scale gestures. *Convenience*, *cost* and *comfort* matter most here.

The diversity of open space, like street trees, parks or off-traffic pathways, promotes walkability. How easily people can access a local transit stop (e.g. buses) affects their tendency to use it (Higashide, 2019). Multi-modal capabilities, like cycle racks at stops, are shown to promote different usages. But competitive services must be cheaper (e.g. 'pay by distance'), faster (e.g. 'bus gates'), easier to use, and more reliable than corresponding car trips.

Cycle stress influences usage; therefore, tracks segregated from vehicular traffic and aligned with low traffic speeds could help 'destress' cyclists. Topography also matters: exhausting slopes are obstacles, which available mobility technology (e-bikes) can address. Roundabouts are demonstrable deterrents to walkability and cyclability and can be re-envisioned to make trips more seamless (e.g. Cambridge's new 'Dutch-style' design) (Reid, 2020).


*Fig. 12. Push-pull factors at the station (Source: Author)*

Finally, the station *environment* is critical. Like home, perceived safety and accessibility affects one's willingness to walk. How comfortably cyclists can enter a station — or lock up, which cycle-hire addresses — affects cycling stress. Station design can also visibly prioritise certain uses: car parking that is closer and less cumbersome than bus service will undoubtedly encourage cars. These factors are exacerbated at night in suburban settings, when street activity is less apparent.

4. ***A holistic approach is needed to promote sustainable last mile solutions.*** No matter the setting, this vast array of factors entails numerous actors with varying interests, from local councils and private developers to rail managers and bus operators. Therefore, last mile solutions demand multi-pronged governance. Various stakeholders must collaborate on improving journey experiences at every step of the way, with the goal to first *equalise* sustainable modes in quality — a politically expedient approach in suburbs, where car usage is higher and preferred. Behavioural shifts take time, and so incremental changes (e.g. Amsterdam's gradual reduction of parking) would allow users and stakeholders alike to consider options.

As shown, this dissertation found an appetite for change across all modes. Furthermore, when asked in interviews if the Covid-19 pandemic had altered mindsets, most users said they enjoyed walking and cycling more. But a hurried return in car traffic as lockdowns lift exemplifies the power of habit.

## 6. Conclusion

A wider understanding of key themes affecting last mile journeys — built environment; travel satisfaction; and attitudes — offers insight into the convergence of factors that creates a trip experience, and, over time, a regular mode choice. Focussing on the last mile, this dissertation put forth a roadmap of relevant push-pull factors, and a capable governance model needed to enact said changes. Yet this approach requires a wholesale shift in how travel is delivered.

For too long, efforts have focused on the services available at a transit hub. But as the last mile shows, travel — and our resulting behaviours — begins much earlier than that; what users encounter at home is as much a part of the equation as the services themselves. Last mile solutions demand that level of nuance; multiple points of contact rather than point A to B.

Thankfully, this shift is underway. Innovations like 'Mobility as a Service' (MaaS) pitch travel as a toolbox of various modes, available from a smartphone app. Cycle-hires, e-scooters and other 'micro-mobility' use last-mile lingo in advertising. Transport apps like CityMapper and Google Maps, which often promote active travel, have raised public awareness of a journey's entirety. Now the Covid-19 pandemic is accelerating this discussion, as both urban and suburban municipalities increasingly pitch hyper-local mobility as integral to economic recovery.

But there is more to be done. Recognising cognitive dissonance and push-pull factors, stakeholders should consider an incentive model, with sustainability as the bottom line. Rather than relying on parking revenue, for example, subsidies to Network Rail can be tied to *lowering* the number of cars. For those who continue to drive for various reasons, all-day parking can be more expensive for petrol-based cars, while EV owners get better and cheaper parking, with the ability to charge while gone. Cycle-hires included in rail fares (e.g. OV-Fiets, operated by Dutch train company NS) could offer seamless multi-modality.

Opportunities are endless when rethinking the last mile to create sustainable travel behaviours. Yet the topic demands interdisciplinary attention if effective measures are to become reality. Up against the paired climate and Covid-19 crises, the time to act is now — with this dissertation lending itself in that pursuit.

**References**


Abdul Hamid, N., Mohamad, J. and Rehan Karim, M. (2008). Travel Behaviour of the Park & Ride Users and the Factors Influencing the Demand for the Use of the Park and Ride Facility. *EASTS International Symposium on Sustainable Transportation incorporating Malaysian Universities Transport Research Forum Conference 2008*.

Aditjandra, P.T. (2013). The impact of urban development patterns on travel behaviour: Lessons learned from a British metropolitan region using macro-analysis and micro-analysis in addressing the sustainability agenda. *Research in Transportation Business & Management*, 7, pp.69–80.

Allatt, A. (2018). What is stopping women from cycling? *BBC News*. [online] 21 Jan. Available at: https://www.bbc.co.uk/news/uk-england-leicestershire-41737483 [Accessed 9 Jul. 2020].

Anable, J. (2005). 'Complacent Car Addicts' or 'Aspiring Environmentalists'? Identifying travel behaviour segments using attitude theory. *Transport Policy*, 12(1), pp.65–78.

Bohte, W., Maat, K. and van Wee, B. (2009). Measuring Attitudes in Research on Residential Self-Selection and Travel Behaviour: A Review of Theories and Empirical Research. *Transport Reviews*, 29(3), pp.325–357.

Carmona, M., Gabrieli, T., Hickman, R., Laopoulou, T. and Livingstone, N. (2018). Street appeal: The value of street improvements. *Progress in Planning*, 126, pp.1–51.

Cervero, R. (1997). Paratransit in America: redefining mass transportation. *Choice Reviews Online*, 34(10), pp.34-5785-34–5785.

Cervero, R. (2001). Walk-and-Ride: Factors Influencing Pedestrian Access to Transit. *Journal of Public Transportation*, 3(4), pp.1–23.

Cervero, R., Denman, S. and Jin, Y. (2019). Network design, built and natural environments, and bicycle commuting: Evidence from British cities and towns. *Transport Policy*, 74, pp.153–164.

Council, O.C. (2020). *Air Quality Annual Status Report 2019 | Oxford City Council*. [online] www.oxford.gov.uk. Available at: https://www.oxford.gov.uk/downloads/file/7334/air_quality_annual_status_report_2019 [Accessed 7 Jul. 2020].

CrashMap (2018). *CrashMap*. [online] Crashmap.co.uk. Available at: https://www.crashmap.co.uk/Search.

De Vos, J. and Witlox, F. (2017). Travel satisfaction revisited. On the pivotal role of travel satisfaction in conceptualising a travel behaviour process. *Transportation Research Part A: Policy and Practice*, 106, pp.364–373.

Department of Transport (2020). *Transport Secretary's statement on coronavirus (COVID-19): 9 May 2020*. [online] GOV.UK. Available at: https://www.gov.uk/government/speeches/transport-secretarys-statement-on-coronavirus-covid-19-9-may-2020 [Accessed 12 May 2020].

Ettema, D., Gärling, T., Olsson, L.E. and Friman, M. (2010). Out-of-home activities, daily travel, and subjective well-being. *Transportation Research Part A: Policy and Practice*, 44(9), pp.723–732.

Ewing, R. and Cervero, R. (2010). Travel and the Built Environment. *Journal of the American Planning Association*, [online] 76(3), pp.265–294. Available at: http://eastportlandactionplan.org/sites/default/files/Ewing_Cervero_JAPA_2010_Travel+BE_MetaAnalysis.pdf [Accessed 13 Jan. 2020].

European Environment Agency (EEA) (2019). *The first and last mile — the key to sustainable urban transport*. Luxembourg: Publications Office of the European Union, 2020.

Fan, A., Chen, X. and Wan, T. (2019). How Have Travelers Changed Mode Choices for First/Last Mile Trips after the Introduction of Bicycle-Sharing Systems: An Empirical Study in Beijing, China. *Journal of Advanced Transportation*, 2019, pp.1–16.

Ffrench, A. (2020). *People say good riddance to dockless bikes in Oxford*. [online] Oxford Mail. Available at: https://www.oxfordmail.co.uk/news/18544282.cyclists-say-good-riddance-dockless-bikes-oxford/ [Accessed 9 Jul. 2020].

Fishman, E., Washington, S. and Haworth, N. (2014). Bike share's impact on car use: Evidence from the United States, Great Britain, and Australia. *Transportation Research Part D: Transport and Environment*, [online] 31, pp.13–20. Available at: http://mobility-workspace.eu/wp-content/uploads/Bike-shares-impact-on-car-use-3.pdf [Accessed 26 Jun. 2019].

Foote, P.J. (2000). Chicago Transit Authority Weekday Park-and-Ride Users: Choice Market with Ridership Growth Potential. *Transportation Research Record: Journal of the Transportation Research Board*, 1735(1), pp.158–168.

Google Maps (2020). *Fig. 2. Map view of both stations.*

Google Maps (2020b). *Fig. 3. The entryway to both stations.*

Google Maps (2020c). *Fig 4. Map view of distance between stations.*

Google Maps (2020d). *Fig. 7. Frideswide Square after redesign*

Handy, S., Cao, X. and Mokhtarian, P. (2005). Correlation or causality between the built environment and travel behavior? Evidence from Northern California. *Transportation Research Part D: Transport and Environment*, 10(6), pp.427–444.

Handy, S., van Wee, B. and Kroesen, M. (2014). Promoting Cycling for Transport: Research Needs and Challenges. *Transport Reviews*, 34(1), pp.4–24.

Hern, A. (2020). Electric scooters to get green light to go on Britain's public roads. *The Guardian*. [online] 16 Mar. Available at: https://www.theguardian.com/politics/2020/mar/16/electric-scooters-get-green-light-to-go-on-britains-public-roads. [Accessed 9 Jul. 2020].

Headicar, P. (2020a). *Oxford Parkway access trip survey data*. [Email].

Headicar, P. (2020b). *Dissertation expert interview*. 25 Jun.

Hickman, R. and Vecia, G. (2016). Discourses, Travel Behaviour and the "Last Mile" in London. *Built Environment*, 42(4), pp.539–553.

Higashide, S. (2019). *Better buses, better cities: how to plan, run, and win the fight for effective transit*. Washington, Dc: Island Press.

Jacobs, J. (1961). *The death and life of great American cities*. New York: Random House, Cop.

Jones, H. (2017). Oxford aims for world's first zero emissions zone with petrol car ban. *The Guardian*. [online] 12 Oct. Available at: https://www.theguardian.com/uk-news/2017/oct/11/oxford-aims-to-cut-air-pollution-car-ban-zero-emissions-zone [Accessed 23 Apr. 2020].

Jones, T., Harms, L. and Heinen, E. (2016). Motives, perceptions and experiences of electric bicycle owners and implications for health, wellbeing and mobility. *Journal of Transport Geography*, 53, pp.41–49.

Jones, P. (2020). *Dissertation expert interview*. 26 Jun.

Kitamura, R., Mokhtarian, P.L. and Daidet, L. (1997). A micro-analysis of land use and travel in five neighborhoods in the San Francisco Bay Area. *Transportation*, 24(2), pp.125–158.

Krizek, K.J. (2003). Residential Relocation and Changes in Urban Travel: Does Neighborhood-Scale Urban Form Matter? Journal of the American Planning Association, 69(3), pp.265–281.

Matthies, E. and Klöckner, C.A. (2015). Car-fixation, socialization, and opportunities for change. *Handbook on Transport and Development*, pp.491–501.

Meek, S., Ison, S. and Enoch, M. (2010). UK local authority attitudes to Park and Ride. *Journal of Transport Geography*, 18(3), pp.372–381.

Meek, S., Ison, S. and Enoch, M. (2011). Evaluating alternative concepts of bus-based park and ride. *Transport Policy*, 18(2), pp.456–467.

Mo, B., Shen, Y. and Zhao, J. (2018). Impact of Built Environment on First- and Last-Mile Travel Mode Choice. *Transportation Research Record: Journal of the Transportation Research Board*, 2672(6), pp.40–51.

Lynch, D. (2020). *Oxfordshire loses out on £300,000 "free money" for cycling from Government*. [online] Oxford Mail. Available at: https://www.oxfordmail.co.uk/news/18554550.oxfordshire-loses-government-funding-cycling-walking/ [Accessed 9 Jul. 2020].

Naess, P. (2012). Urban form and travel behavior: experience from a Nordic context. *Journal of Transport and Land Use*, 5(2).

Network Rail (2020). *Railway Upgrade Plan*. [online] Network Rail. Available at: https://www.networkrail.co.uk/running-the-railway/railway-upgrade-plan/.

Newman, P. and Kentworthy, J.R. (1999). *Sustainability and Cities: Overcoming Automobile Dependence*. Island Press.

Newman, P.G. and Kenworthy, J.R. (1989). *CITIES AND AUTOMOBILE DEPENDENCE: AN INTERNATIONAL SOURCEBOOK*. [online] *trid.trb.org*. Available at: https://trid.trb.org/view/351194 [Accessed 14 Jul. 2020].

Newman, P. and Kenworthy, J.R. (1999). *Sustainability and cities : overcoming automobile dependence*. Washington, D.C.: Island Press.

O'Sullivan, F. (2020). Britain Is Creating a Government Organization Devoted to Biking and Walking. [online] www.bloomberg.com. Available at: https://www.bloomberg.com/news/articles/2020-07-29/why-the-u-k-is-investing-big-in-cycling-and-walking [Accessed 7 Aug. 2020].

Office of Rail and Road (2017). *Estimates of station usage | ORR Data Portal*. [online] Orr.gov.uk. Available at: https://dataportal.orr.gov.uk/statistics/usage/estimates-of-station-usage/.

Office for National Statistics (2011). *2011 Census - Office for National Statistics*. [online] Ons.gov.uk. Available at: https://www.ons.gov.uk/census/2011census.

Ogden, C. (2019). *Serious growth in e-bike sales predicted by 2050 - Environment Journal*. [online] Environment Journal. Available at: https://environmentjournal.online/articles/serious-growth-in-e-bike-sales-predicted-by-2050/ [Accessed 9 Jul. 2020]

Oxford Bus Company (2020). *OXFORD BUS COMPANY TO WITHDRAW PICKMEUP SERVICE FOLLOWING TWO YEAR PILOT SCHEME*. [online] Mynewsdesk. Available at: https://www.mynewsdesk.com/uk/oxford-bus-company/pressreleases/oxford-bus-company-to-withdraw-pickmeup-service-following-two-year-pilot-scheme-2997978 [Accessed 9 Jul. 2020].

Oxford City Council (2020). *Air Quality Annual Status Report 2019*. [online] Available at: https://www.oxford.gov.uk/downloads/file/7334/air_quality_annual_status_report_2019.

Oxfordshire County Council (2020). *Connecting Oxfordshire | Oxfordshire County Council*. [online] http://www.oxfordshire.gov.uk. Available at: https://www.oxfordshire.gov.uk/residents/roads-and-transport/connecting-oxfordshire [Accessed 9 Jul. 2020].

Oxfordshire County Council (2020a). *Active travel | Oxfordshire County Council*. [online] http://www.oxfordshire.gov.uk. Available at: https://www.oxfordshire.gov.uk/residents/roads-and-transport/active-travel [Accessed 9 Jul. 2020].

News, O. (2017). *Cowley roundabout is second most dangerous in Britain*. [online] The Oxford Student. Available at: https://www.oxfordstudent.com/2017/02/22/cowley-roundabout-second-dangerous-britain/ [Accessed 8 Jun. 2020].

Park, S. (2008). *Defining, Measuring, and Evaluating Path Walkability, and Testing Its Impacts on Transit Users' Mode Choice and Walking Distance to the Station*. PhD Thesis.

Parkhurst, G. (1995). Park and ride: Could it lead to an increase in car traffic? *Transport Policy*, 2(1), pp.15–23.

Parkhurst, G. (1996). The Economic and Modal-split Impacts of Short-range Park and Ride Schemes: Evidence from Nine UK Cities. *ESRC Transport Studies Unit*.

Reid, C. (2020). *Cambridge's New 1 million GBP Roundabout Slows Motorists, Favouring Cyclists And Pedestrians. [online] Forbes. Available at: htttps://www.forbes.com/sites/carltonreid/2020/07/30/Cambridges-new-1-million-roundabout-slows-motorists-favoring-cyclists-and-pedestrians/#2d8a5aca5586* [Accessed 18 Aug 2020]

Roberts, J. (2019). *Commuters in Oxford are among most stressed in UK*. [online] Oxford Mail. Available at: https://www.oxfordmail.co.uk/news/17633914.commuters-oxford-sixth-stressed-uk-survey-finds/ [Accessed 8 Jun. 2020].

Schwanen, T., Banister, D. and Anable, J. (2012). Rethinking habits and their role in behaviour change: the case of low-carbon mobility. *Journal of Transport Geography*, 24, pp.522–532.

Shoup, D. (2005). *High Cost of Free Parking*. S.L.: Routledge.

Shriver, K. (n.d.). Influence of Environmental Design on Pedestrian Travel Behavior in Four Austin Neighborhoods. *Transportation Research Record*, [online] 1578(1), pp.64–75. Available at: https://www.academia.edu/6200301/Influence_of_Environmental_Design_on_Pedestrian_Travel_Behavior_in_Four_Austin_Neighborhoods [Accessed 14 Apr. 2020].

Sims R., R. Schaeffer, F. Creutzig, X. Cruz-Núñez, M. D'Agosto, D. Dimitriu, M.J. Figueroa Meza, L. Fulton, S. Kobayashi, O. Lah, A. McKinnon, P. Newman, M. Ouyang, J.J. Schauer, D. Sperling, and G. Tiwari, 2014: Transport. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S.

Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA

Steer Davies Gleave and Department of Transport (2018). *Economic Impacts of new or improved rail lines: Oxford Parkway Case Study*. Department of Transport.

Steg, L. (2005). Car use: lust and must. Instrumental, symbolic and affective motives for car use. *Transportation Research Part A: Policy and Practice*, [online] 39(2–3), pp.147–162. Available at: https://www.sciencedirect.com/science/article/pii/S0965856404001016.

Stone, J., Chae, K. and Pillalamarri, S. (2002). The Effects of Roundabouts on Pedestrian Safety. *The Southeastern Transportation Center*.

Stutzer, A. and Frey, B.S. (2008). Stress that Doesn't Pay: The Commuting Paradox*. *Scandinavian Journal of Economics*, 110(2), pp.339–366.

Tennøy, A., Hanssen, J.U. and Øksenholt, K.V. (2019). Developing a tool for assessing park-and-ride facilities in a sustainable mobility perspective. *Urban, Planning and Transport Research*, 8(1), pp.1–23.

Tilahun, N. and Li, M. (2015). Walking Access to Transit Stations. *Transportation Research Record: Journal of the Transportation Research Board*, 2534(1), pp.16–23.

Tilahun, N., Thakuriah, P. (Vonu), Li, M. and Keita, Y. (2016). Transit use and the work commute: Analyzing the role of last mile issues. *Journal of Transport Geography*, 54, pp.359–368.

UCL (2014). *Travel Experience Survey 2014*.

Whitehead, D. (2020). *Coronavirus: Bike sales surge as commuters search for "new, isolated" travel*. [online] Sky News. Available at: https://news.sky.com/story/coronavirus-bike-sales-surge-as-commuters-search-for-new-isolated-travel-11997757 [Accessed 9 Jul. 2020].

Weinstein Agrawal, A., Schlossberg, M. and Irvin, K. (2008). How Far, by Which Route and Why? A Spatial Analysis of Pedestrian Preference. *Journal of Urban Design*, 13(1), pp.81–98.

Ye, R. and Titheridge, H. (2017). Satisfaction with the commute: The role of travel mode choice, built environment and attitudes. *Transportation Research Part D: Transport and Environment*, [online] 52, pp.535–547. Available at: https://www.sciencedirect.com/science/article/pii/S1361920915302145.

Yin, C., Shao, C. and Wang, X. (2018). Built Environment and Parking Availability: Impacts on Car Ownership and Use. *Sustainability*, 10(7), p.2285.

**Appendices**

1. ***Survey questionnaire***

***Background***

1. **What is your gender?**
    a. Male
    b. Female
    c. Other (please state)

2. **What is your age?**
    a. 0-18
    b. 18-25
    c. 25-36
    d. 36-50
    e. 50-65
    f. 65+

3. **What is your ethnicity?**
    a. European White
    b. African/Black
    c. Asian/South Asian
    d. Latino
    e. Other (please state)

4. **How many people live in your household, including yourself?**
    a. 1
    b. 2
    c. 3
    d. 4+

5. **Do you have children living at home?**
    a. Yes
    b. No

6. **What is your highest education level?**
    a. None
    b. Primary school
    c. Secondary school
    d. Graduate

7. **What is your employment status?**
    a. Full-time employed
    b. Part-time employed
    c. Self-employed
    d. Unemployed
    e. Home worker/carer
    f. Student
    g. Retired

8. **In your main job, how many hours a week (including paid and unpaid overtime) do you usually work?**
    a. 15 or less
    b. 16 - 30
    c. 31 - 48
    d. 49 or more

9. **What is your housing situation?**
    a. Owns outright
    b. Owns with a mortgage or loan
    c. Part owns and part rents (shared ownership)
    d. Rents (with or without housing benefit)
    e. Lives here rent free

10. **Where do you live?**
    a. A whole house or bungalow that is:
        i. detached
        ii. semi-detached
        iii. terraced (including end-terrace)
    b. A flat, maisonette or apartment that is:
        i. in a purpose-built block of flats or tenement
        ii. part of a converted or shared house (including bedsits)
        iii. in a commercial building (for example, in an office building, hotel, or over a shop)
    c. A mobile or temporary structure:
        i. a caravan or other mobile or temporary structure

11. **What is your household income level?**
    a. £0-£30,000
    b. £30,000-£60,000
    c. £60,000-£100,000
    d. £100,000 and above

***Typical travel to the nearest rail station***

*Think of your most recent trips to a rail station in Oxford. (Before the COVID-19 lockdown.)*

1. **What station do you normally commute from?**
    a. Oxford City Centre
    b. Oxford Parkway

2. **Is this the closest station to your house?**
    a. Yes
    b. No (If not… what is?)

3. **What mode do you most often take to get to the station?**
    a. Public bus
    b. Cycle
    c. Walk
    d. Private car (driver)
    e. Car passenger

f. Rideshare (carpool, car club)
g. Taxi
h. Shared bike (Mobike, etc.)

4. **Is this your usual mode of transport to the rail station?**
    a. Yes
    b. No (If not, what is?)

5. **Is this your usual mode of transport for most activities?**
    a. Yes
    b. No (If not, what is?)

6. **How often do you commute to the rail station?**
    a. Every weekday
    b. Few days a week
    c. Few times a month
    d. Once a month
    e. Few times a year

7. **How many people do you travel with on most trips?**
    a. 0
    b. 1
    c. 2
    d. >3

8. **What is your trip's typical purpose?**
    a. Work
    b. Education
    c. Shopping
    d. Meeting friends or family
    e. Other leisure
    f. Other

**Individual characteristics and attitudes to travel**

9. **In total, how many cars or vans are owned, or available for use, by members of this household?**
    a. 0
    b. 1
    c. 2
    d. 3+

10. **How many bicycles do you have access to at home?**
    a. 0
    b. 1
    c. 2
    d. 3+

11. **Do you plan on purchasing a car in the next two years?**
    a. No
    b. Maybe

c. Yes

**12. How important is the proximity to the rail station to you?**

a. Very important
b. Important
c. Neither
d. Unimportant
e. Very unimportant

**13. What are your opinions on the following statements?**

*This question relates to your general travel*

(Strongly agree/Somewhat agree/Neutral/Somewhat disagree/Strongly disagree)

a. I generally like to travel
b. My commute is an important part of my day
c. I want to live a sustainable lifestyle
d. Environmental concerns do not influence my travel - other factors are much more important, such as travel convenience and comfort
e. I think about the environmental impact when travelling, but often I still take the car most of the time
f. Environmental impact plays a big role in my daily decision-making - it influences how I travel
g. My travel mode choices have little impact on the environment - I walk and cycle most of the time
h. Mostly I use public transport for travel
i. I never use a car for travel
j. Individual actions do not matter for the environment; societal and political change is needed
k. I am willing to walk and cycle more, but the facilities need much improvement
l. I am willing to use public transport more, but the quality of services need much improvement
m. Owning a car is too expensive
n. Getting stuck in traffic doesn't bother me too much - I much prefer travelling by car
o. Travelling by public transport is unreliable

**14. What is your preferred mode choice?**

a. Public bus
b. Cycle
c. Walk
d. Private car (driver)
e. Car passenger
f. Rideshare (carpool, car club)
g. Taxi
h. Shared bike (Mobike, etc.)

**How much do you agree with the following statements?**

(Disagree, relatively disagree, neutral, relatively agree, agree)

**If car/car passenger/rideshare/taxi:**

My car is a part of my personality
A nice car is important to me
I find driving relaxing
Driving makes life easier
My car isn't dependent on anyone else

I can choose my own route
Driving saves time
Driving protects me against unprotected weather

**If cycle/shared bike:**

I enjoy cycling as it keeps me fit
I consider myself a cyclist
I find cycling relaxing
I like cycling because it's inexpensive
Cycling makes life easier
My bike isn't dependent on anyone else
I can choose my own route
Cycling saves time

**If walk:**

I enjoy walking as it keeps me fit
Walking is a key source of exercise for me
I find walking relaxing
I consider myself a walker
Walking allows me to think/listen to music
Walking saves time
Walking saves money

**If bus:**

I enjoy taking the bus
The bus is safe
I take the bus because it's fast
I take the bus because it's cheap
Taking the bus allows me to think/listen to music

**15. How satisfied are you living in your neighborhood?**

a. Very satisfied
b. Satisfied
c. Dissatisfied
d. Very dissatisfied
e. Other (please explain)

**16. What were the main reasons for choosing to live in your neighborhood? (Select five)**

| | | | |
|---|---|---|---|
| **Change in workplace (new job)** | | **To be close to family/friends** | |
| **Access to existing workplace** | | **Retirement** | |

| | | | |
|---|---|---|---|
| **To live in a good environment** | | **Marriage/other relationship change** | |
| **To be near to good schools** | | **Access to the public transport network** | |
| **To be close to shops and leisure activities** | | **Access to the cycling network** | |
| **To rent or buy your first home** | | **Access to the road network** | |
| **The rental or purchase price of this home** | | **Because you like this neighbourhood** | |
| **To move to a bigger house** | | **Other (*Please state*) _____** | |
| **To move to a smaller house** | | | |

***Built environment***

*Please enter your home postcode*
*Please enter your work postcode*

**16. How far from the rail station do you live?**

a. 0-1 km
b. 1-5 km
c. 5-10 km
d. 10-20 km
e. 20+ km

**17. How far from your local neighbourhood centre do you live?**

a. 0-1 km
b. 1-5 km
c. 5-10 km
d. 10-20 km
e. 20+ km

**18. Along your usual route to the railway station, do you pass through a residential area or a commercial area?**

a. Residential
b. Commercial
c. Mixed (both)

19. **Along your usual route to the railway station, do you pass through any natural areas (canals, bridleways, forest, etc.)?**
    a. Yes
    b. No
    c. I don't know

20. **Do you have free car parking in your household?**
    a. Yes
    b. No
    c. I don't know

21. **Do you have available cycle parking in your household?**
    a. Yes
    b. No

22. **Do you have safe bike parking in your household?**
    a. Yes
    b. No
    c. I don't know

23. **What is your opinion of the car parking provided in your neighbourhood?**
    (Strongly agree, agree, neither, disagree, strongly disagree)

a. Close to home
b. With enough spaces for residents
c. With enough spaces for visitors
d. At a reasonable cost
e. Satisfactory overall

24. **What is your opinion of the bike parking provided in your neighbourhood?**
    (Strongly agree, agree, neither, disagree, strongly disagree)

a. Close to home
b. With enough spaces for residents
c. With enough spaces for visitors
d. At a reasonable cost
e. Satisfactory overall

25. **What is your opinion of the car parking provided at the railway station?**
    (Strongly agree, agree, neither, disagree, strongly disagree)

a. With enough spaces for me
b. At a reasonable cost
c. Satisfactory overall

26. **What is your opinion of the bike parking provided at the railway station?**
    (Strongly agree, agree, neither, disagree, strongly disagree)

a. With enough spaces for me

b. At a reasonable cost
c. Safe to leave my bike
d. Satisfactory overall

**27. How many road intersections do you have to pass on your trip to the rail station?**

a. 1
b. 2
c. 3
d. 4+

***Travel well-being***

**28. How long is your typical commute to the station?**

a. <5 minutes
b. 5-15 minutes
c. 15-30 minutes
d. >30 minutes

**29. How satisfied are you with the typical time it takes to get to the station?**

a. Completely satisfied
b. Somewhat satisfied
c. Neutral
d. Somewhat dissatisfied
e. Completely dissatisfied

**30. How satisfied are you with the cost of the typical trip to the station?**

a. Completely satisfied
b. Somewhat satisfied
c. Neutral
d. Somewhat dissatisfied
e. Completely dissatisfied

**31. How would you rate the trip on this scale? (1-5)**

a. Rushed <-> Relaxed
b. Concerned <-> Confident
c. Stressed <-> Calm
d. Tired <-> Lively
e. Bored <-> Engaged

**32. What is your satisfaction with the travel experience overall?**

a. Completely satisfied
b. Somewhat satisfied
c. Neutral
d. Somewhat dissatisfied
e. Completely dissatisfied

**33. If you walked to the station, what would the experience be like?**

a. Largely safe
b. Relatively safe
c. Neutral

d. Relatively unsafe
e. Largely unsafe

**34. If you walked to the station, how long would it take?**

a. <5 minutes
b. 5-15 minutes
c. 15-30 minutes
d. >30 minutes

**35. If you cycled to the station, what would the experience be like?**

a. Largely safe
b. Relatively safe
c. Neutral
d. Relatively unsafe
e. Largely unsafe

**36. What is the usual traffic level on your way to the station?**

a. Low (1-5 cars on route, minimal traffic)
b. Medium (5-20 cars on route, medium traffic)
c. Heavy (20+ cars on route, heavy traffic)

**37. Do you encounter any traffic roundabouts on your way to the station?**

a. Yes
b. No
c. I don't know

***Policy interventions***

**38. If the council introduced a direct segregated cycle route from your household to the station, would you consider switching your mode choice?**

a. Very likely
b. Somewhat likely
c. Neutral
d. Somewhat unlikely
e. Very unlikely

**39. If the council introduced better public transport links (bus, paratransit: van, shuttle, etc.) from your household to the station, would you consider switching your mode choice?**

a. Very likely
b. Somewhat likely
c. Neutral
d. Somewhat unlikely
e. Very unlikely

**40. If the council created a better walking environment near the station, would you consider switching your mode choice?**

a. Very likely
b. Somewhat likely
c. Neutral
d. Somewhat unlikely

e. Very unlikely

**41. If the council introduced micro-mobility technology (scooters, e-bikes, or cycleshare) near your household and at the station, would you consider switching your mode choice?**

a. Very likely
b. Somewhat likely
c. Neutral
d. Somewhat unlikely
e. Very unlikely

**42. If the council introduced higher density, mixed-use development around the station, would you consider living in an area like this?**

a. Very likely
b. Somewhat likely
c. Neutral
d. Somewhat unlikely
e. Very unlikely

**43. If the council introduced measures to reduce the supply/raise the costs of car parking at the station, would you consider switching your mode choice?**

a. Very likely
b. Somewhat likely
c. Neutral
d. Somewhat unlikely
e. Very unlikely

**44. If the council introduced measures to create safer cycle parking at the station, would you consider switching your mode choice?**

a. Very likely
b. Somewhat likely
c. Neutral
d. Somewhat unlikely
e. Very unlikely

**45. If the council introduced measures to raise the costs of on-street parking near your home, would you consider switching your mode choice?**

a. Very likely
b. Somewhat likely
c. Neutral
d. Somewhat unlikely
e. Very unlikely

**46. If the council introduced measures to create safer cycle parking near your home, would you consider switching your mode choice?**

a. Very likely
b. Somewhat likely
c. Neutral
d. Somewhat unlikely
e. Very unlikely

47. **Would you support the council being much more radical in building a sustainable transport system (i.e. removing street space for the car and giving this to public transport, walking and cycling)?**
    a. Very likely
    b. Somewhat likely
    c. Neutral
    d. Somewhat unlikely
    e. Very unlikely

**We are also keen to understand travel in more detail. Please fill in a one-day travel diary from the last week of normal mobility:**

48. **Single day travel diary**

*Please fill out the trips made in a typical weekday (before the COVID-19 lockdown):*

| *Time period* | *Activity* | *Origin* | *Destination* | *Journey length (time)* | *Mode* |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

*Thanks for completing the survey! Your contribution will go towards understanding and improving sustainable travel solutions in Oxford and the UK.*

**Would you be interested in a 15-minute follow-up interview for this travel study? If so, please include your email:**

### *2. Survey Landing Page*

Hello, and welcome to this survey!

It is a vital part of my MSc dissertation in Transport & City Planning at University College London (UCL)'s The Bartlett School of Planning, where I'm researching last mile solutions to two commuter rail stations: Oxford & Oxford Parkway.

These questions will pertain to access trips (from your house to the rail station) you've taken over the last three months, likely before the COVID-19 lockdown began in March. By participating, you are helping to foster knowledge into more sustainable, greener transport options to and from commuter rail stations in the UK and beyond, as well as potential solutions in the years ahead. Please feel free to share this survey with other colleagues or family members who may be interested.

The survey should take about 10-15 minutes to complete, and will be open from Monday, May 11th to Monday, May 25th. Responses are entirely anonymous, and your privacy is protected through UCL's encrypted data protocols. Any additional feedback is encouraged — this is your time to talk!

Your time is greatly appreciated. Thank you.

Start

***

### *3. Survey promotional material*

***

### *4. Demographic data sources*

*Oxfordshire & England/Wales*

Education/Employment: *https://public.tableau.com/profile/graham.occ#!/vizhome/qualifications/Qualifications*

Age: *https://insight.oxfordshire.gov.uk/cms/system/files/documents/RINews_Nov14_FINAL.pdf*

*https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland*

***

### *5. Categorical designations for quantitative analysis*

Individual characteristics

**Gender**

Male = 1
Female = 2
Other = 3

**Age**

18-25 = 1
26-35 = 2
36-50 = 3
51-64 = 4
65+ = 5

**Employment**

Part-time employed: 1
Unemployed: 2
Full-time employed: 3
Self-employed: 4
Student: 5
Retired: 6
Home worker/carer: 7

**Household Income**

Â£0-Â£30,000 = 1
Â£30,000-Â£60,000 = 2
Â£60,000-Â£100,000 = 3

Â£100,000 and above = 4

**Household Size**

1 = 1
2 = 2
3 = 3
4+ = 4

**Children**

No: 1
Yes: 2

**Housing Type**

A whole house or bungalow that is: detached - 1
A whole house or bungalow that is: semi-detached - 2
A flat that is: part of a converted or shared house - 3
A whole house or bungalow that is: terraced - 4
A flat that is: in a purpose-built block of flats or tenement - 5
A mobile or temporary structure - 6
A flat that is: in a commercial building - 7

**Housing Situation**

Lives here rent free - 1
Rents (with or without housing benefit) - 2
Owns with a mortgage or loan - 3
Owns outright - 4
Part owns and part rents (shared ownership) - 5

Attitudes

1: Completely disagree
2: Somewhat disagree
3: Neutral
4: Somewhat agree
5: Completely agree

***

Travel Satisfaction

**Overall trip/walk time:**

<5 minutes: 0
5-15 minutes: 1
15-30 minutes: 2
>30 minutes: 3

**Cost/time/overall satisfaction**

Completely dissatisfied: 0
Somewhat dissatisfied: 1
No opinion: 2
Somewhat satisfied: 3
Completely satisfied: 4

**Walk/cycle experience**

Largely unsafe: 0
Relatively unsafe: 1
Neutral: 2
Relatively safe: 3
Largely safe: 4

***

Built Environment

**Density**

Low (0-500 ppc): 1
Medium (500-1,000 ppc): 2
High (1,000+ ppc): 3

OX1: 3
OX2: 2
OX3: 3
OX5: 1
OX33: 1
OX12: 1

**Diversity**

Residential (0-.5): 1
Mixed (.5-1): 2
Commercial (1+): 3

OX1 (Oxford):
OX2 (Jericho): Average of .89, .93, .86, .94, 1.33 (Vale of White Horse, Cherwell, Oxford, Buckinghamshire, Wycombe) = **.99**
OX3 (Headington): Average of .93, 1.33 (Cherwell, Oxford) = **1.13**
OX4 (Cowley): Average of 1.33, .85 = **1.09**
OX5 (Cherwell):
OX12: Vale of Whitehorse **(.89)**
OX33: Average of .93 (Cherwell), .86 (Buckinghamshire), .79 (Aylesbury Vale), 1.33 (Oxford) = **.9775**

**Design**

Cul-de-sac = 1
Grid = 2
Commercial road = 3

**Destination Accessibility**

Available Car Parking at Home
Available Cycle Parking at Home
Safe Cycle Parking at Home

Yes: 1
No: 2
I don't know: 3

Cars at Home
Bikes at Home

0: 0
1: 1
2: 2
3+: 3

**Car/Cycling Parking Attitudes**

1: Completely disagree
2: Somewhat disagree
3: Neutral
4: Somewhat agree
5: Completely agree

**Pricing**

Free: 1
0-5 £: 2
5-10 £: 3
10+ £: 4

**Distance to station/downtown**

0-1 km: 1
1-5 km: 2
5-10km: 3
***

### *6. Interview tags*

**Tags**

*Interview 1:* Female, 65+, Retired

*Interview 2:* Male, 18-25, Part-time employed

*Interview 3:* Male, 26-35, Full-time employed

*Interview 4:* Female, 51-64, Full-time employed

*Interview 5:* Female, 18-25, Student

*Interview 6:* Female, 36-50, Unemployed

*Interview 7:* Female, 26-35, Student

*Interview 8:* Male, 26-35, Full-time employed

*Interview 9:* Male, 65+, Retired

*Interview 10:* Female, 65+, Retired

**Questions for interviews**

1. Paint me a picture of your commute to your railway station.
2. You said in the survey that you were X with your trip time or cost. Can you explain why?
3. You said in the survey that you were X with this intervention. Can you explain why?
4. How has your commute changed in light of the Covid-19 pandemic?

***

*7. Healthy Streets Check*

**Name of scheme**
Conducted on 5/17/2020

Oxford vs. Oxford Parkway


Source: Lucy Saunders

**Healthy Streets Indicators' scores (%)**
(Results will only display once all metrics have been scored)

| | Frideswid | Oxford |
|---|---|---|
| Pedestrians from all walks of life | 69 | 43 |
| Easy to cross | 67 | 37 |
| Shade and shelter | 67 | 50 |
| Places to stop and rest | 80 | 33 |
| Not too noisy | 47 | 40 |
| People choose to walk, cycle and use public transport | 69 | 43 |
| People feel safe | 65 | 41 |
| Things to see and do | 78 | 50 |
| People feel relaxed | 70 | 44 |
| Clean Air | 50 | 42 |
| Overall Healthy Streets Check score | 68 | 42 |
| Number of 'zero' scores | 3 | 4 |

***

*8. Risk Assessment Form*

**RISK ASSESSMENT FORM**
**FIELD / LOCATION WORK**

The Approved Code of Practice - Management of Fieldwork should be referred to when completing this form: http://www.ucl.ac.uk/estates/safetynet/guidance/fieldwork/acop.pdf

**DEPARTMENT/SECTION:** THE BARTLETT SCHOOL OF PLANNING/TRANSPORT & CITY PLANNING
**LOCATION(S):** OXFORD, UK
**PERSONS COVERED BY THE RISK ASSESSMENT:** MYSELF/SURVEY PARTICIPANTS

**BRIEF DESCRIPTION OF FIELDWORK:** Online survey via Opinio and semi-structured interviews via Microsoft Teams with Oxford residents on access trips (before national lockdown) to respective rail stations.

**Consider, in turn, each hazard (white on black). If NO hazard exists select NO and move to next hazard section. If a hazard does exist select YES and assess the risks that could arise from that hazard in the risk assessment box.**
**Where risks are identified that are not adequately controlled they must be brought to the attention of your Departmental Management who should put temporary control measures in place or stop the work. Detail such risks in the final section.**

| | |
|---|---|
| ENVIRONMENT | The environment always represents a safety hazard. Use space below to identify and assess any risks associated with this hazard |

| | |
|---|---|
| e.g. location, climate, terrain, neighbourhood, in outside organizations, pollution, animals. | NO |

| | |
|---|---|
| CONTROL MEASURES | Indicate which procedures are in place to control the identified risk |

| | |
|---|---|
| | work abroad incorporates Foreign Office advice |
| | participants have been trained and given all necessary information |
| | only accredited centres are used for rural field work |
| | participants will wear appropriate clothing and footwear for the specified environment |
| | trained leaders accompany the trip |
| | refuge is available |
| | work in outside organisations is subject to their having satisfactory H&S procedures in place |
| | OTHER CONTROL MEASURES: please specify any other control measures you have implemented: |

| | |
|---|---|
| EMERGENCIES | Where emergencies may arise use space below to identify and assess any risks |

| | |
|---|---|
| e.g. fire, accidents | NO |

| | |
|---|---|
| CONTROL MEASURES | Indicate which procedures are in place to control the identified risk |

| | |
|---|---|
| | participants have registered with LOCATE at http://www.fco.gov.uk/en/travel-and-living-abroad/ |
| | fire fighting equipment is carried on the trip and participants know how to use it |
| | contact numbers for emergency services are known to all participants |
| | participants have means of contacting emergency services |
| | participants have been trained and given all necessary information |
| | a plan for rescue has been formulated, all parties understand the procedure |
| | the plan for rescue /emergency has a reciprocal element |
| | OTHER CONTROL MEASURES: please specify any other control measures you have implemented: |

FIELDWORK 1 May 2020

| | | | |
|---|---|---|---|
| EQUIPMENT | Is equipment | NO | If 'No' move to next hazard |

| | | | |
|---|---|---|---|
| [redacted] | | | If 'Yes' use space below to identify and assess any |
| e.g. clothing, outboard motors. | | | |

| | |
|---|---|
| CONTROL MEASURES | **Indicate which procedures are in place to control the identified risk** |

| | |
|---|---|
| | the departmental written Arrangement for equipment is followed |
| | participants have been provided with any necessary equipment appropriate for the work |
| | all equipment has been inspected, before issue, by a competent person |
| | all users have been advised of correct use |
| | special equipment is only issued to persons trained in its use by a competent person |
| | OTHER CONTROL MEASURES: please specify any other control measures you have implemented: |

| | | | |
|---|---|---|---|
| LONE WORKING | Is lone working | NO | If 'No' move to next hazard |

| | | | |
|---|---|---|---|
| [redacted] | a possibility? | | If 'Yes' use space below to identify and assess any |

| | |
|---|---|
| e.g. alone or in isolation lone interviews. | Examples of risk: difficult to summon help. Is the risk high / medium / low? |

| | |
|---|---|
| CONTROL MEASURES | **Indicate which procedures are in place to control the identified risk** |

| | |
|---|---|
| | the departmental written Arrangement for lone/out of hours working for field work is followed |
| | lone or isolated working is not allowed |
| | location, route and expected time of return of lone workers is logged daily before work commences |
| | all workers have the means of raising an alarm in the event of an emergency, e.g. phone, flare, whistle |
| | all workers are fully familiar with emergency procedures |
| | OTHER CONTROL MEASURES: please specify any other control measures you have implemented: |

| ILL HEALTH | The possibility of ill health always represents a safety hazard. Use space below to identify and assess any risks associated with this Hazard. |
|---|---|
| *e.g. accident, illness, personal attack, special personal considerations or vulnerabilities.* | |

| CONTROL MEASURES | **Indicate which procedures are in place to control the identified risk** |
|---|---|

| | |
|---|---|
| | an appropriate number of trained first-aiders and first aid kits are present on the field trip |
| | all participants have had the necessary inoculations/ carry appropriate prophylactics |
| | participants have been advised of the physical demands of the trip and are deemed to be physically suited |
| | participants have been adequate advice on harmful plants, animals and substances they may encounter |
| | participants who require medication have advised the leader of this and carry sufficient medication for their needs |
| | OTHER CONTROL MEASURES: please specify any other control measures you have implemented: |

| | | | | |
|---|---|---|---|---|
| TRANSPORT | Will transport be | NO | X | Move to next hazard |
| | required | YES | | Use space below to identify and assess any risks |
| e.g. hired vehicles | Examples of risk: accidents arising from lack of maintenance, suitability or training | | | |

| | |
|---|---|
| **CONTROL MEASURES** | **Indicate which procedures are in place to control the identified risk** |

| | |
|---|---|
| | only public transport will be used |
| | the vehicle will be hired from a reputable supplier |
| | transport must be properly maintained in compliance with relevant national regulations |
| | drivers comply with UCL Policy on Drivers http://www.ucl.ac.uk/hr/docs/college_drivers.php |
| | drivers have been trained and hold the appropriate licence |
| | there will be more than one driver to prevent driver/operator fatigue, and there will be adequate rest periods |
| | sufficient spare parts carried to meet foreseeable emergencies |
| | OTHER CONTROL MEASURES: please specify any other control measures you have implemented: |

| | | | |
|---|---|---|---|
| DEALING WITH THE PUBLIC | Will people be | YES | If 'No' move to next hazard |

| | | | |
|---|---|---|---|
| [redacted] | dealing with public | | If 'Yes' use space below to identify and assess any |
| *e.g. interviews, observing* | *LOW risk. The interviews will be conducted online, thus minimising impact of in-face interaction. Furthermore, the author has significant experience in interviewing, with a background in journalism.* | | |

| | |
|---|---|
| **CONTROL MEASURES** | *Indicate which procedures are in place to control the identified risk* |

| | |
|---|---|
| | all participants are trained in interviewing techniques |
| | interviews are contracted out to a third party |
| | advice and support from local groups has been sought |
| | participants do not wear clothes that might cause offence or attract unwanted attention |
| | interviews are conducted at neutral locations or where neither party could be at risk |
| | OTHER CONTROL MEASURES: please specify any other control measures you have implemented: |

FIELDWORK May 2020

| | | | |
|---|---|---|---|
| WORKING ON OR NEAR WATER | Will people work on or near water? | NO | If 'No' move to next hazard<br>If 'Yes' use space below to identify and assess any risks |
| *e.g. rivers, marshland, sea.* | Examples of risk: drowning, malaria, hepatitis A, parasites. Is the risk high / medium / low? | | |

| | |
|---|---|
| CONTROL MEASURES | Indicate which procedures are in place to control the identified risk |

| | |
|---|---|
| | lone working on or near water will not be allowed |
| | coastguard information is understood; all work takes place outside those times when tides could prove a threat |
| | all participants are competent swimmers |
| | participants always wear adequate protective equipment, e.g. buoyancy aids, wellingtons |
| | boat is operated by a competent person |
| | all boats are equipped with an alternative means of propulsion e.g. oars |

| | |
|---|---|
| | participants have received any appropriate inoculations |
| | OTHER CONTROL MEASURES: please specify any other control measures you have implemented: |

| | | | |
|---|---|---|---|
| MANUAL HANDLING (MH) | Do MH activities take place? | NO | If 'No' move to next hazard<br>If 'Yes' use space below to identify and assess any risks |
| e.g. lifting, carrying, moving large or heavy equipment, physical unsuitability for the task. | Examples of risk: strain, cuts, broken bones. Is the risk high / medium / low? | | |

| | |
|---|---|
| CONTROL MEASURES | **Indicate which procedures are in place to control the identified risk** |

| | |
|---|---|
| | the departmental written Arrangement for MH is followed |
| | the supervisor has attended a MH risk assessment course |
| | all tasks are within reasonable limits, persons physically unsuited to the MH task are prohibited from such activities |
| | |

| | |
|---|---|
| | all persons performing MH tasks are adequately trained |
| | equipment components will be assembled on site |
| | any MH task outside the competence of staff will be done by contractors |
| | OTHER CONTROL MEASURES: please specify any other control measures you have implemented: |

FIELDWORK 4 May 2020

| | | | |
|---|---|---|---|
| SUBSTANCES | Will participants work with substances | NO | If 'No' move to next hazard<br>If 'Yes' use space below to identify and assess any risks |
| e.g. plants, chemical, biohazard, waste | Examples of risk: ill health - poisoning, infection, illness, burns, cuts. Is the risk high / medium / low? | | |
| CONTROL MEASURES | **Indicate which procedures are in place to control the identified risk** | | |

| | |
|---|---|
| | the departmental written Arrangements for dealing with hazardous substances and waste are followed |
| | all participants are given information, training and protective equipment for hazardous substances they may encounter |
| | |

| | |
|---|---|
| | participants who have allergies have advised the leader of this and carry sufficient medication for their needs |
| | waste is disposed of in a responsible manner |
| | suitable containers are provided for hazardous waste |
| | OTHER CONTROL MEASURES: please specify any other control measures you have implemented: |

| | | | |
|---|---|---|---|
| OTHER HAZARDS | Have you identified any other hazards? | NO | If 'No' move to next section<br>If 'Yes' use space below to identify and assess any risks |
| i.e. any other hazards must be noted and assessed here. | Hazard:<br>Risk: is the risk | | |
| CONTROL MEASURES | **Give details of control measures in place to control the identified risks** | | |

| | | |
|---|---|---|
| Have you identified any risks that are not | NO X | Move to Declaration |

| | | |
|---|---|---|
| adequately controlled? | YES | Use space below to identify the risk and what action was taken |

Is this project subject to the UCL requirements on the ethics of Non-NHS Human Research? NO

If yes, please state your Project ID Number

For more information, please refer to: http://ethics.grad.ucl.ac.uk/

DECLARATION

The work will be reassessed whenever there is a significant change and at least annually. Those participating in the work have read the assessment.

Select the appropriate statement:

| | |
|---|---|
| X | I the undersigned have assessed the activity and associated risks and declare that there is no significant residual risk |
| X | I the undersigned have assessed the activity and associated risks and declare that the risk will be controlled by |

| | | | |
|---|---|---|---|
| | the method(s) listed above | | |
| | **NAME OF SUPERVISOR:** Dr. Robin Hickman | | John M. Surico |
| | FIELDWORK | 5 | May 2020 |